

TAXONOMY, MORPHOLOGY AND BIOLOGY OF
SERICOPHORINE WASPS

WITH DIAGNOSES OF TWO NEW GENERA AND DESCRIPTIONS OF
FORTY NEW SPECIES AND SIX SUB-SPECIES

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Plates I–II.; Figs. 1–9

INTRODUCTION

The fossorial sericophorine wasps investigated in this research are endemic to Australia, and of economic importance. It is, therefore, rather surprising that they should hitherto have received so little attention by students of the HYMENOPTERA.

The long delay in investigating the biology—the first species was described as far back as 1851—may be due to their inconspicuous habits, for most of the life of the female is spent in sinking shafts in sandy ground, a labour at which she is exceedingly efficient. Since her prey, (flies), is abundant, little time is given to hunting and garnering in the field, consequently, few opportunities are present to observe her actions.

The hunting is interrupted by hurried visits to the flowers of certain plants, chiefly Myrtaceae (for the adults are strictly vegetarian in their diet) and since the blossoms are often borne high on trees, the harvesting wasps are rarely observed. The "meat" is reserved exclusively for the young.

The gross morphology is singularly stable, and good specific characters are neither easily discovered nor described. Since they are all microscopic, the work of the taxonomist is of a critical nature, and the observation of the biology places a strain on the patience of the investigator.

Stability of structure is usually accepted by evolutionists as evidence of early origin, and the fact that one species described in this paper is from a Tasmanian locality, indicates that the wasps had extended to the island before its separation from the mainland by Bass Strait.

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CENSUS OF SPECIES

Dalla Torre, "*Catalogus Hymenopterorum*", listed only five species in this sub-family. This research adds two new genera; 40 new species; and six new sub-species, bringing the total number of sericophorine wasps to 43 valid species.

DISTRIBUTION

The early recorders of locality could do little better than indicate " New Holland " for Australia, although " Swan River " is given for *Sericophorus bicolor* Smith. Species in the author's hands were collected in Queensland (11); New South Wales (15); Victoria (12); South Australia (6); Western Australia (8); Northern Territory (1); and Tasmania (1); while no records have been received from either New Zealand or New Guinea. Now that these insects are better known, there is little doubt that more new species will be taken by collectors, for it is evident that these beneficial wasps are not rare, but widely distributed over the several states.

COLLECTORS

The names of the first collectors are not now available, for the early taxonomists frequently did not include them in their descriptions—perhaps because they did not possess the information. The more recent collectors are indicated under the several specific descriptions included in this paper.

PLANTS VISITED

BY ADULT WASPS FOR POLLEN AND NECTAR

<i>Eucalyptus ficifolia</i>	Myrtaceae	<i>S. teliferopodus</i>	Sandringham, V.
Garden flowers	Various	<i>S. rufipes</i>	Kerang, V.
<i>Bursaria spinosa</i>	Pittosporaceae	<i>S. teliferopodus</i>	Warburton, V.
<i>Eucalyptus</i> sp.	Myrtaceae	Subsp. <i>okiellus</i>	Melton, V.
<i>E. redunca</i> var. <i>elata</i>	.. ..	<i>S. sydneyi</i>	Bolgart, W.A.
<i>Bursaria spinosa</i>	Pittosporaceae	<i>S. spryi</i>	Mordialloc, V.
<i>B. spinosa</i>	.. ..	<i>S. claviger</i>	.. .. V.
<i>Leptospermum</i> sp.	Myrtaceae	<i>S. rufipes</i>	Mt. Victoria, V.
<i>L. scoparium</i>	.. ..	<i>S. chalybaeus</i>	Gorae West, V.
<i>L. scoparium</i>	.. ..	<i>S. cliffordi</i>	Gorae West, V.
<i>Eucalyptus Kitsoniana</i>	.. ..	<i>S. cliffordi</i>	Gorae West, V.
<i>Eucalyptus</i> sp.	.. ..	<i>S. gracilis</i>	Glen Aplin, Nth.Q.
<i>Eucalyptus</i> sp.	.. ..	<i>S. elegantior</i>	Bolgart, W.A.
<i>Lomatia</i> sp.	.. ..	<i>S. chalybaeus</i>	Lane Cove, N.S.W.
<i>Baeckea</i> sp.	.. ..	<i>S. rufipes</i>	Fraser Pk., N.S.W.
<i>Kunzia ambigua</i>	.. ..	<i>S. rufipes</i>	Woollahra, N.S.W.

TAXONOMIC POSITION

Family SPHECIDAE

Subfamily SERICOPHORINAE

Genus SERICOPHORUS Shuckard, Nomen nudum

(*Sericum*—silk, *fero*—I bear)

Lardner's Cabinet Encyclo., VII., p. 181, 1840

SERICOPHORUS Smith

Ann. Mag. Nat. Hist. (2) VII., p. 32, 1851

TACHYRRHOSTUS Saussure

Mem. Soc. Phys. Hist. Nat. Genève, XIV., I., p. 24, 1854

Isogenotypic with SERICOPHORUS Smith

Sericophorus chalybaeus Smith

Ann. Mag. Nat. Hist. (2) VII., p. 32, 1851

Syn. *Tachyrrhostus cyaneus* Saussure

Melang. Hymen., fasc. I., p. 69, 1854

NEW CHARACTERS

Males were unknown to the above authors, and no worker appears to have dissected a female, consequently mouth-parts and genitalia could not be described. The author is more fortunately situated, and has been able to dissect both sexes. This research demonstrated that the most stable specific characters are of value in the order given—structure of epinotum; form of penis-valves of genitalia; clypeal teeth or nodes on anterior margin; disposition of tarsal rakes; pygidial plates and apical sterna of the abdomen; distance between recurrent and intercubitus nervures.

The microscopic structure of the propodium almost defeats intelligible description, thus making it necessary to include a number of drawings—although these fall far short of adequate representation, yet they will assist the student in his determinations. All the parts are presented in oblique dorsal views to show the declivity as well as the dorsum of the epinotum.

The species may be separated in two distinctive groups—one comprised of larger bluish or greenish wasps, e.g. *S. chalybaeus* Sm.; the other of smaller black insects, often ornamented with red and yellow markings e.g. *S. relucens* Sm., with *S. pescotti* Raym. annectant between *S. nigror* Raym. and *S. relucens* Sm.

That the genus is a difficult one for the taxonomist is demonstrated by the labels on certain of the specimens—only one specimen was determined correctly; indeed, one was labelled *Megachile*, and another *Halictus*.

It seems advisable, in the light of this research, to amplify Smith's rather meagre generic diagnosis.

Sericophorus, Shuckard et Smith, stat. nov.

Head transverse, not so wide as the thorax, minus tori; insertion of scapes low on the face, and joined by a transverse suture on which the frontal carina often terminates; vertex excessively narrow, and the lateral ocelli not compressed. The clypeus of the females bears on its anterior margin two or three minute nodular teeth which appear to be correlated to the inner incisure of the mandibles, on the outer margin of which is a larger node; anterior margins of the compound eyes almost parallel, and converge on the vertex only slightly. Flagellum short, clavate, median segments often produced to a node; apical segment usually modified, especially in the males; the frons bears a tubercle, either large or small, and supraclypeal area not defined; the small genae are unarmed, and there is no malar area; labrum small and oval, with a fringe of stiff setae; antennae with twelve segments in both sexes.

The mouth-parts are elemental, glossa short and deeply emarginate, bearing numbers of short stout truncated setae; four segments in the labial palpus and six in the maxillary; galea with comb on inner surface; mentum short and broad; salivarium not conspicuously developed, and when considered in relation to the ducts of the pharyngeal plate, it would appear that glandular secretions play little part in the physiology of the species, and none has been observed. The

stipes are broadly developed, but short, and the galea conspicuously banded with darker colour. (Pl. I., No. 1); 24 minute organs on anterior margin of glossa. (Pl. I., No. 3.)

The prothoracic collar is appressed on the scutum, and dorsally appears as a mere line; median scutal and parapsidal lines are conspicuous; scutellum often tuberculate; postscutellum small; propodium or epinotum large; and laterad of the dorsum more or less rugose; the cruciform incisure is divided into a number of quadrate pits by short transverse rugae.

Abdomen smaller than the thorax, basal segments widest, and sometimes produced to a dorsal tubercle, apical segments slender, with a pygidial plate close-set with spines, and the flexible abdomen may be thrust far forward to bring the short curved sting into action; the gonostyli are well developed, with a microscopic vestiture of hair.

The genital capsule of the smaller male is peculiar, the dentate penis-valves (Michener) offer a specific character (pl. I., No. 6); gonostyli slender and hairy.

Legs stout; tibiae armed with rows of spiculae, anterior femur strongly developed, although all are adapted for efficient digging; the anterior basitarsi bear a strong rake of spines; the strigilis is of primitive character, and the two hind calcaria are unequal in length; the fifth tarsus is large, and the pulvillus excessively so. Its function is discussed elsewhere, but it may be spread like a close net when digging.

The neuration of the wings is distinctive, for the first recurrent enters the first cubital cell, the second cubital cell is almost an equilateral triangle, and receives the second intercubitus nervure usually beyond the middle; pterostigma well developed, and the dozen or more hamuli indicate a long range of flight. Rare specimens have only two cubital cells.

The insects are almost naked, and most of the simple hair is found about the metathoracic region. In the green species, the integument is almost entirely sericeous; in the black species the appressed hair has a metallic lustre. The wasps are of medium size, but of robust stature, and females easily outnumber males in all collections; only three described species are represented by both sexes. Males have only the anterior angle of the clypeus produced to a small tooth, and lack the lateral nodes of the females; they may be known by this character.

The cruciform structure of the epinotum or propodium has parallels in several genera of SPHECIDAE, and Arnold (1940) illustrates the triangular structure of *Psenulus patei* Arn. and *P. stevensoni* Arn., two Ethiopian wasps with a rugose dorsum not unlike that of *Sericophorus rugosus* Raym. Similar structures are present in *Dolichururus seçindus* Arn. and *Alysson seyrigi* Arn., and certain species of *Crabro*.

The pleural or episternal suture of the mesopleuron in *Sericophorus* is also conspicuous in many other SPHECIDAE, and as Doctor Arnold rightly points out, the suture is present in bees in the genus *Hylæus* (fig. 2, No. 1).

PHYLOGENY

Students of the HYMENOPTERA agree that bees are derived from fossorial wasps, and *Sericophorus* appears to be closer to the APOIDEA than any other genus in the family SPHECIDAE, for there are many parallels in morphology, food, architecture and behaviour. (See *Astaurus*, gen. nov.)

The wasps are not, of course, endowed with plumose hairs, only the simple ones of hunting insects; they are therefore precluded from gathering a large load of pollen. However, that physical limitation should not of itself debar the wasps from supplying their young with pollen, because bees in the genera *Hylaeus*, *Hylaeoides*, *Meroglossa*, and indeed several other genera, are no better equipped with harvesting implements, consequently, they are compelled to carry pollen mixed with nectar in the honey-sac. The grains are swept into the mouth with the brushes of the anterior tarsi.

The head of the wasps and the bees is small; the genae but little developed, and the ocelli, compound eyes, and antennae are similar to those of *Paracolletes*, the most primitive of the bees, and with which the author proposes to draw comparisons.

The scapes of the wasps are inserted much lower down on the "face", so that the subantennal area is eliminated; the clypeus, too, is much shorter, but the small narrow oval of the labrum is similar in the two insects, so is the epistomal suture. The face lacks tori in both bee and wasp.

The clypeal nodules of *Scricophorus* are not present in *Paracolletes*, although clypeal teeth are excessively developed in *Megachile*. The "teeth" of the wasp are adapted to the incision of the inner margin of the mandibulae, but there is no homologous structure on the mandibles of any bee. The facial foveae are reduced to mere dark marks in both insects. (Compare clypeus of *Anacrucis clypeata*, sp. nov.)

The mouthparts of each conform to a primitive plan; the short broad glossa being deeply emarginate; the maxillary palpus having six equal segments, and the labial palpus four; mentum short and broad, and this, when added to the heavy stipes, gives an almost circular outline to the mouthparts; those of the bee are more slender. The lacinia is present in the wasps, but not in the bees, which have a larger galea. The salivarium is not so prominent in the wasps as in the bees, which use a copious secretion to weave silvery colloidal skin cells, but there is no evidence of a similar membranous substance in the cells of *Scricophorus*.

The thoraces have many features in common, but the wasp has the elevated horizontal dorsum of the epinotum, with many rugae, a character not prominent in *Paracolletes*, but very evident in many bees such as *Binghamiella* and *Halictus*. The horizontal dorsum is surely a primitive character. The mesophragma is somewhat similar in both genera.

The abdomen does not present any distinctive characters, for there are six visible segments in the females, and seven in the males, and both wasps and bees have a pygidial plate, that of the former bearing a number of stout spines. *Paracolletes* does not transport the bulk of the pollen on an abdominal scopa, but on the hind tibiae and femora.

The femora of the posterior legs are well developed in bees, but they are stout on the anterior legs of *Sericophorus*, for the posterior legs are the busiest for bees; the anterior pair do most of the excavating for the wasps.

In *Sericophorus* the legs are armed with numbers of stout spiculae, and rows of short nodes persist in fossorial bees such as *Euryglossa* and other archaic genera. The tarsi also are similarly armed, and one *Paracolletes* in the author's collection has unique long laminate lateral processes on the fore-tarsi. The hind basitarsi of female bees are usually short and broad; those of males slender; the latter form is elemental, and present in both sexes of the wasps.

Toothed claws, as in *Paracolletes*, are regarded by Michener (1944) as the more primitive, but those of *Sericophorus* are simple; the unequal hind calcaria of the wasp have a parallel in the bee *Goniocolletes* (Raym. 1935). There is no recognizable patella or knee-plate in Sericophorines, although it is prominent in Colletid bees. No fossorial bee possesses the excessively developed pulvillus of the wasps; the velum of the wasp's strigilis is narrow and serrate, and therefore nearer to that of ants than to *Paracolletes*.

The penis-valves of the genitalia in the wasps are free of the penis, but in the bees there is an intimate association. The curved sting of the female wasp is neither long nor particularly well developed, and the slender gonostyli are almost nude; the sting is weaker in *Paracolletes*.

The neuration of the wings in *Sericophorus* differs from that of *Paracolletes* in one important character; the first cubital cell receives the first recurrent nervure and the small second cubital cell is triangular; it is more nearly quadrate in *Paracolletes*. The large pterostigma may be regarded as a primitive character of the wasps, but it is inconspicuous in the bees; the hamuli are, on the average, fewer in the wasps. In two mutations of *Sericophorus* the second intercubitus nervure is obsolescent, thus leaving the insect with only two large cubital cells as in certain PARACOLLETINAE, e.g. *Lysicolletes* Raym., which also has spiculae on the tibiae.

A tendency to develop the high narrow third cubital cell of *Apis*, the hive-bee, is seen in such sphecids as *Tachytes* and *Notogonidea*; *Sericophorus* appears to link such genera with the lower wasps having subquadrate third cubitals.

The wings of the wasp and the bee are covered closely with fine hairs, but both lack the short stout alar-papillae present in the distal portion of wings of the higher bees such as *Anthophora* and *Bombus*. It is just possible to identify the vestiges of the alar-fenestrae in *Sericophorus*; they are more prominent in many bees, including certain *Haliicti*, and *Binghamiella* especially.

It will be seen, then, that the gross morphology of wasp and bee has many affinities, and does not present any spectacular contrasts, hence the strong superficial likeness to the metallic-green bees *Paracolletes elegans* Sm. and *P. pictus* Raym.

A fundamental difference exists however in the diet of the larvae, if not of the adults, for while the young of the wasps is exclusively a meat-eater, the larva of the bee is vegetarian. The adults of both consume nectar—hydrocarbon, and pollen—nitrogenous protein, and it would appear that the substitution of pollen for meat in the diet of the young bee did not result in any loss of vigour, but rather an access of energy; the change increased the industry of the bees. The hunter has always been at a disadvantage when compared with the cultivator—even in the species *Homo*.

The choice of site, in sandy ground, and the building habits of the two insects are very similar, and the earth-works of one could easily be mistaken for those of the other, although the bees construct more extensive shafts.

The author has seen workers of the highest bees, *Apis* suddenly yield to the primitive instinct to excavate, and hundreds assembled to dig frenziedly in the damp soil at the bottom of a new post-hole.

The silk and pebble cocoons of the wasps are more substantial than the delicate membrane of the bees, but the oval cell is typical of both. Mutillids prey equally on the larvae of both insects.

The bees require twelve months for the completion of the life-cycle, and probably the number of progeny produced by the two females closely approximates. More than twelve months are required for the development of *Sericophorus* at low temperatures, but eleven months appear to be the normal period.

Since typical specimens of green *Sericophorus* are present in Tasmania, one postulates that the wasps reached the island before its separation from the mainland; the *S. retucens* complex appears

to be more recent, since it has not yet been reported from the island. Colletid bees are well represented in Australia, and have many affinities with the insect-fauna of South America.

It would appear, from the evidence adduced, that the sericophorine wasps and the colletid bees are the ancient abutments of the bridge linking fossorial wasps and bees which reached Australia at some remote period, "when it was connected, or nearly connected, by land with other Continents, for the Colletidae . . . are perhaps as old as the Cretaceous." (Michener, 1944.)

There are six genera in the Subfamily SERICOPHORINAE; *Sericophorus* Sm.; *Helioryctes* Sm.; *Sphodrotes* Kohl.; *Zoyphium* Kohl.; and *Paranysson* Guerin, and these may be identified by the following comparisons. (See *Anacrucis*, gen. nov.)

Compared with *Sericophorus*, *Paranysson* is comprised of dull insects, coarsely and closely punctured, but not sericeous; face without tori; clypeal teeth adapted to mandibular notch as in *Sericophorus*; mandibles conspicuously excised on the outer margin; antennae subfiliform, apical segments acute, other segments not at all "knotted" (fast knotig erscheint); compound eyes converging above; anterior ocellus largest.

Prothorax larger; scutal and parapsidal furrows practically obsolete; abdomen larger than the thorax; metathorax smaller, with a semi-circular rugose area, and a small lateral tooth on some species; abdomen with truncated base, and without the spiny pygidial plate.

Legs slender, anterior tibiae without spines, but tarsal comb present; on the whole, the legs are not so conspicuously armed; the fifth tarsus and pulvillus small. Wings dark-fuliginous, second cubital cell small and petiolate, receiving the second recurrent nervure at its apical corner as in *Sericophorus*; first recurrent entering the first cubital cell; pterostigma moderately developed; hamuli numerous; posterior calcariae unequal.

Helioryctes conforms with the above diagnosis, and Arnold (1922), in his excellent Keys to the Ethiopian SPHECIDAE, gives the same characters for both genera. The specific description of *H. melanopyrus* (Gambia) would serve for *Paranysson helioryctoides* Turn. (Southern Rhodesia), and except for size, the very much larger *P. quadridentatus* Cam., (Victoria Falls); all have a black head and thorax, with ferruginous abdomen and legs, and dark wings, and resemble *Anacrucis ferruginea*, sp. nov.

It will be observed that these two genera are exceedingly close, but both differ sharply from *Sericophorus*, which includes a few species with ferruginous abdomen, and *Anacrucis*, which are almost entirely black.

The following characters distinguish the small wasps, 7 mm. approx. in length, in the genus *Helioryctes* Smith. The oval compound eyes converge on the vertex; antennae filiform, the apical segment acute; anterior clypeal margin not dentate; mandibles acute apically, and not toothed on the inner margin.

Pronotal collar well defined from above, and not appressed to the scutum as in *Sericophorus*.

Metathorax short and truncated, with the dorsum defined by a semi-circular ruga enclosing a reticulated area; there is a micro laterally, at about the middle of the truncation.

Abdomen larger than the thorax, and truncate at the base; apical segment carinate laterally; no pygidial plate.

Anterior legs have the tibiae unarmed, but the basitarsi have a slender comb; fifth tarsus and pulvillus not excessively developed as in *Sericophorus*.

The abdomen of *H. melanopyrus* Sm. has a ferruginous abdomen after the manner of *Paranysson* species and the *bicolor* group of *Sericophorus*, but they are easily separated on the characters given above.

Kohl concluded that "in a narrow way", *Zoyphium* had some affinity with *Sericophorus*=*Tachyrhostus*, consequently, there is a distant relationship to *Anacrucis*, which can easily be separated from Kohl's two Australian genera by certain characters which are included here for comparison.

*Zoyphium*¹ has lateral extensions of the prothoracic collar, and the second abdominal segment on the back, at both sides, is provided with a lateral tooth directed backwards (abdominis segmentum secundum dorsale utrinque dente retracto instructum).

It should be remembered that Kohl invariably referred to the metathorax, propodium or epinotum as the first abdominal segment, which is correct morphologically. The locality is given as Australia, and the male is unknown.

Williams (1919) gives a figure of the hooked femora of the male wasp, *Hylotiris mandibularis* Williams (LARRINAE). The remarkable structure is doubtless homologous with that found on Australian bees in the genus *Gonicolletes*, and is evidence in support of the contention that bees evolved from fossorial wasps.

1. Eine neue Hymenopterengattung Verh. k.k. Zool.-bot. Ges. Wien, 43, p. 569—572, 1893.

*Sphodrotes*² is based on a male wasp coarsely punctured after the manner of *Paranysson*, with the well-developed genae giving the head a quadrate aspect. The anterior orbital margins are parallel, and the exterior margin of the mandibles deeply excised (mandibulae interdum margine exteriore profunde excisae). The second cubital cell is said to be petiolate. The locality is given as New South Wales, and the female is unknown.

The author has had no wasps conforming with the specific descriptions, and is forced to rely on the generic diagnoses for the above characters.

NOTES ON ANATOMY

A female wasp, *S. teliferopodus* Raym., was taken at 5.20 a.m., on the 27th December, 1950, as she was about to descend her shaft. She did not bear any prey, and was probably returning after visiting the flowers of *Eucalyptus ficifolia*, which was then at the zenith of its inflorescence. She was dissected two hours later.

The largest organs of the flagellum are formed somewhat like a scoop standing vertically over a clear circle of light; there are miniature ones of similar form, and a number of dark leaf-like structures of medium size. No attempt could be made to study the functions of any.

The truncated stout setae of the glossa are bent at a right-angle, like a wall-bracket, and apparently would be of little service in spreading any colloidal secretion. Silken or membranous "cradle-gowns", such as are woven by colletid bees, have not been observed.

The paraglossae of many species are close-set with stout setae exactly reproducing in miniature the pattern of the pygidium, Pl. 3, No. 8. The labial palpus of *S. viridis roddi* has the basal and apical segments longest and equal, the two others shorter and subequal. The basal segment is longest in *S. teliferopodus*.

There appeared to be only two ovarian tubules, each containing about fifteen eggs at various stages of development; two very large, and it was evident that these were ready for the two cells under construction; two a little smaller; six of half size; ten very small; ten minute.

Since three weeks approximately are required for the excavation of one shaft with its two cells, and the provisioning of them, and the active period limited to 21 weeks, it is more than probable that less than half the eggs are matured and utilized.

2. Neue Gattungen aus der Hymenopteren—Family der spheciden—Ann. k.k. Hofmus, Wien 4, p. 188-196, 1889.

Seven shafts, each having two cells, with twelve blowflies in each cell, appears to be the maximum effort that could be achieved by one wasp. If this be the case, then each female would require 168 male flies for the season.

The malpighian tubules are much more numerous than in halictine bees, for there appears to be about 50 in all—there are twelve or so in *Halictus*; and perhaps 100 in the hive-bee *Apis*.

The ventriculus is large, but not so well developed as it is in bees, for the "corrugated" aspect of the exterior is inconspicuous, and the walls appear to be thin and membranous. It contained a thin pasty amber-coloured substance, which was chiefly honey.

Rectal glands are prominent, and apparently formed like those of wild-bees, but none could be mounted for critical examination under the microscope.

The function of the 24 tiny urn-like organs along the anterior margin of the glossa could not be investigated, but one postulates, from their position and form, that they are probably organs of taste. Silk and other glandular secretions play little part in the physiology of the species.

Abdominal air-sacs are well-developed on each side dorsally of the abdomen, and the tracheae numerous, and in keeping with her powers of flight, while the wing-muscles are strongly developed.

There is not the close association of penis and valves in the genitalia that one sees in bees. The "claspers" are of specific value, and so are the serrations, but the genitalia must be mounted for critical study.

The pygidium of the males is broader, and the spines much finer than those of the females, but the apical sterna of the males possess characters of specific value. Since both sexes have only twelve segments in the flagellum, it is necessary to study the teeth and nodes of the clypeus; the males having only one tooth; the females two or three. This is a sex character.

The "strands" of the pulvillus are held together by numerous short curved transverse setae, but which nevertheless permit of a considerable lateral movement (see pl. I., No. 5).

PORE ORGANS

McIndoo (1914) claimed that the many groups of pore-organs which he found on various parts of the honey-bee were olfactory in function, but the experiments of other authors do not confirm his conclusions.

The present author has found most of McIndoo's groups of pore-organs on Australian wild-bees, and it would appear that many of them are present also in sericophorine wasps; there is little doubt that most are homologous with those of the bee.

There is a remarkable group of ten, in two rows of five, at the articulation of the trochanters of *S. relucens* Sm. (See pl. 6, No. 10.)

There are larger groups of pore-organs at the articulation of the coxae, and other groups are present on the bases of the wings. No attempt was made to identify all the groups, and their function could not be investigated.

Dr. W. H. Thorpe after surveying the remarkable experiments of Prof. K. von Frisch, concluded that the bee's ability to orientate itself is probably determined by the pull of gravity registered by the "proprioceptive" sense organs at the limb and abdominal articulations—Nature, 2nd. July, 1949.

RELATIONSHIPS

By the character of the lateral rugae of the epinotum the sericophorine species may be grouped as follows:—

1. Blue, with fewer coarse short rugae, *S. chalybaeus*; *S. violaceus*; *S. minutus*; *S. cyanophilus*; *S. elegantior*; *S. spryi*; *S. claviger*; *S. gracillis*; *S. occidentalis*.
2. Greenish-blue, with more numerous finer rugae, *S. inornatus*; *S. sydneyi*; *S. rufipes*; *S. lilacinus*; *S. subviridis*; *S. victoriensis*; *S. littoralis*.
3. Green, with fewer coarser rugae, *S. teliferopodus*; *S. viridis* Sauss.
4. Bluish-green, with coarse rugae persisting over the dorsum, *S. cliffordi*; *S. patongensis*; *S. rugosus*; *S. metallescens*; *S. rufotibialis*; *S. niveifrons*. The bar of the cruciform incisure is hardly defined in this group.
5. Reddish abdomen, *S. bicolor*; *S. hackeri*; *S. castaneus*; *S. brisbanensis*.
6. Black species, *S. carinatus*; *S. relucens*; *S. rufobasalis*; *S. froggatti*; and *S. pescotti* approaches group 4, but *S. nigror* is distinct.

KEY TO SPECIES

Abdomen blue	..	..	..	..	..	1
Abdomen green	..	..	..	..	..	4
Abdomen ferruginous	..	..	..	..	..	15
Abdomen black	..	..	..	..	..	16
Scutellum red	..	..	..	..	..	17
Scutellum black	..	..	..	..	..	18

Large, shining, violet, femora and tibiae ferruginous 1

1. Two blunt nodes on clypeal margin, *S. violaceus* Raym. (Small. *S. spryi* Raym. falls here with one black clypeal node.)

Femora and tarsi blue, abdomen apically black 2

2. Three large nodes on anterior clypeal margin, *S. gracilis* Raym. (*S. elegantior* Raym. falls here, but is easily separated by the three small clypeal teeth, and entirely clear-ferruginous legs and antennae; also *S. niveifrons* Raym. with two clypeal teeth.)

- Smaller, shining, peacock-blue with three clypeal nodes 3
 3. All tibiae and tarsi piceous, *S. patongensis* Raym. (*S. rufo-tibialis* Raym. falls here with no clypeal teeth; *S. metallescens* Raym. metallic-green, with one stout node on anterior margin of clypeus; *S. tallongensis* Raym. with black head and one clypeal tooth, and *S. rugosus* Raym. which is smaller, with two clypeal teeth like the female of *S. Cliffordi* Raym.; the male of which has only one tooth.)
- Abdomen apically, tibiae and tarsi all red 4
 4. Angle of clypeus with a sharp tooth, *S. claviger* Kohl. (Subsp. *burnsiellus* Raym. falls here, with an excavated apical segment of the brown antennae; also *S. minutus* Raym., which is the smallest with a sharp clypeal angle.)
- Large, entirely dull, green-blue 5
 5. Clypeus with three large nodes, *S. chalybaeus* Sm.
- Abdomen dull bluish-green, outer clypeal node largest of three 6
 6. Scutellum green, with a black tubercle, *S. rufipes* Raym.
- Scutellum black, with a larger tubercle, two outer clypeal nodes large .. 7
 7. Metathorax shining blue, *S. subviridis* Raym.
- Entirely shining green, abdomen with bronze and lilac tints 8
 8. Clypeus, antennae, and femora all bright red, *S. viridis* (Sauss). (The subsp. *roddi* Raym. falls here, with the clypeus suffused laterally with bluish colour, femora red, but coxae and trochanters bluish.)
- Larger, femora blue basally 9
 9. Clypeus darker, with two prominent teeth, *S. teliferopodus* Raym. (Subsp. *okiellus* Raym. falls here, with many fine transverse rugae on the epinotum.)
- Femora red, two teeth on clypeal margin, dull 10
 10. Short peg-like spines on the pygidium, *S. victoriensis* Raym.
- Femora and scapes greenish-blue 11
 11. Clypeal margin with three nodular teeth, *S. chalybaeus* Sm. (*S. cyanophilus* Raym. falls here with brown tarsi and a rugose clypeus with three teeth; also *S. lilacinus* Raym. with smooth clypeus and three teeth; bright-ferruginous legs, and lilac lustre on abdomen. *S. littoralis* Raym. falls here, with two clypeal teeth, the outer one largest; antennae and tarsi ferruginous; head and thorax blackish-blue.)
- Clypeal margin with three teeth, but long fine spines on pygidial plate .. 12
 12. Third cubital cell not contracted at the top, *S. sydneyi* Raym.
- Larger, with only trochanters and coxae blackish 13
 13. Third cubital cell contracted at the top, *S. victoriensis* Raym.
- Green, nervures of wings pale-amber 14
 14. Hair of epinotum black tipped with white, *S. teliferopodus* Raym.
- Small, clypeus blue, thorax blue 15
 15. Abdomen entirely bright-ferruginous, *S. bicolor* Sm.
- Large, black abdomen 16
 16. Clypeus with ivory-coloured markings, *S. nigror* Raym.
- Clypeus black, without a median carina 17
 17. Small, with the scutella red, *S. relucens* Sm. (The subsp. *ruficornis* Raym. falls here, with ferruginous antennae. The subsp. *nigricornis* Raym. has black antennae. *S. rufobasalis* Raym. is much smaller, with the basal segment of the abdomen entirely red.)

Larger, clypeus with a median carina 18

18. Dorsum of propodium minus a sharp rim, *S. carinatus* Raym. By the serrated process of the genitalia, and the apical sternum of the male, the species *S. chalybaeus* Sm. is related to *S. violaceus* Raym. and *S. rufotibialis* Raym.

Dorsum bounded by a sharp rim 19

19. Scutellum black, abdomen long, *S. pescotti* Raym. There are two bands of ivory-colour on the black prothoracic collar of this species, and this instantly separates it from *S. relucens* Sm., which has the ivory bands on a red collar. (The smaller *S. froggatti* Raym. falls here with a short globose abdomen.)

SUPPLEMENTARY KEY

All very small species

- | | |
|--|---|
| Abdomen clear pale-ferruginous | 1 |
| 1. Nervures and tegulae palest-amber, <i>S. bicolor</i> Sm. | |
| Abdomen dark-castaneus | 2 |
| 2. Clypeus with two nodular teeth, <i>S. castaneus</i> Raym. | |
| Metathorax with "honey-comb" rugae | 3 |
| 3. Clypeus with one tooth, <i>S. brisbanensis</i> Raym. | |
| Metathorax without "honey-comb" rugae | 4 |
| 4. Tegulae reddish, <i>S. hackeri</i> Raym. | |
| Clypeus coarsely rugose | 5 |
| 5. Wings with a brownish tint, <i>S. castaneus</i> Raym. | |
| Clypeus with fine close punctures | 6 |
| 6. Wings with a milky tint, <i>S. hackeri</i> Raym. | |

SPECIFIC DESCRIPTIONS

Sericophorus bicolor, Smith, stat. nov.

Female.—Length, 7 mm. approximately. Bluish-green, with apricot-coloured abdomen.

Head transverse, bluish or greenish; face with foveae reduced to small dark marks; frons sericeous, a low median rise; clypeus convex, blue, anterior margin ivory, with two minute nodular teeth; supraclypeal area not defined; vertex with short black hair; compound eyes reniform; genae with fine piliferous punctures; labrum reddish; mandibulae ivory-coloured, reddish apically; antennae entirely pale-amber or apricot-colour, with a black dot apically.

Prothorax from above shows as a fine blue line; tubercles brownish-blue; mesothorax bluish-green, with a sericeous sculpture, but it is brighter, and tending to become rugose, white hair; scutellum subtuberculate, closely punctate; postscutellum more closely punctate; metathorax coarsely rugose at the sides of the cruciform structure, considerable white hair; abdominal dorsal segments entirely pale-apricot colour; pygidial plate with long fine whitish spines, minute piliferous punctures; ventral segments more shining.

Legs same colour as abdomen, only the coxae are blue; the large pulvillus is black in strong contrast to the fifth tarsus; claws and hind calcar same colour as abdomen; tegulae apricot-colour; wings faintly yellowish, first recurrent far distant from the first intercubitus; nervures palest-amber; cells not normal for the genus, the third cubital almost quadrate; pterostigma small, pale-amber; hamuli eight or so.

Locality.—Cooper's Creek, Central Australia, leg. J. G. Reuther. Swan River, Western Australia, Coll. unknown.

Specimen in the collection of the South Australian Museum.

Allies: It is not certain that the Central Australian insect is conspecific with the western wasp. The Cooper's Creek specimen is of a beautiful purplish-blue, and on one wing a portion of the second recurrent is duplicated. This record greatly extends the range of this beautiful species (see No. 19, pl. 3).

Sericophorus brisbanensis, sp. nov.

Type, male.—Length 6 mm. approximately. Blue, with light castaneous abdomen.

Head with scanty white hair, finely punctured; frons with a median sulcus as in *castaneus*; clypeus with one tooth on convex anterior margin; supraclypeal area not defined, but punctation finer and closer; vertex practically nude; compound eyes with anterior margins parallel; genae nude; labrum ferruginous; glossa very much longer than in the *relucens* complex; mandibulae ferruginous, reddish apically; antennae with bluish scapes and castaneous flagella.

Prothorax with a line of white hair; tubercles blackish, with a line of white hair; mesothorax dull rich blue, large close punctures connected with short lines; scutellum shining, punctures not so close; postscutellum with closer smaller punctures; metathorax with coarse hexagonal rugae like honeycomb; a little white hair on dorsum, shaft of cruciform structure short and broad; abdominal dorsal segments of a lighter, brighter castaneous-red; posterior margins paler-amber; pygidial plate with long fine spines; ventral segments similar.

Legs blue, with ferruginous tibiae; tarsi ferruginous; anterior comb with four spines; claws red; hind calcar reddish; tegulae dull-amber, suffused with bluish; wings milky; nervures palest-amber; second recurrent very close to second intercubitus; cells; third cubital rather large; pterostigma very pale-amber.

Locality.—Brisbane, Queensland, 15th February, 1916, leg. H. Hacker.

Type in the collection of the Queensland Museum.

Allies: Looks just like *S. castaneus*, which has two clypeal teeth, but structure of metathorax very different.

Sericophorus carinatus, sp. nov.

Type, female.—Length 9.5 mm. approximately. Black, red legs.

Head transverse, clothed with dense ochreous appressed hair; face with a minute swelling, punctures contiguous; frons bears a minute carina; clypeus with the anterior margin polished, and two small nodular teeth; supraclypeal area with a raised median line or carina; on vertex foveae defined as lunate purple marks; compound eyes converging slightly above; genae with appressed white hair; labrum black; mandibulae black, spoonlike, not acute as in *relucens*, a median amber mark; antennae short, black, segments wider than long.

Prothorax red, with a wide ivory band; tubercles ferruginous; mesothorax excessively closely punctured, a spot of silvery hair laterally at the scutellar suture; scutellum and postscutellum red, closely punctured; metathorax lacks the large angular tooth laterally, and thus is close to *S. relucens*; abdominal dorsal segment one polished, scattered punctures, the appressed silvery hair of the abdomen so disposed that only alternative halves are seen, hind margins black (amber in *relucens*); ventral segments polished.

Legs red; tarsi darker; claws red; hind calcar very curved, amber; wings hyaline; the recurrent nervures at subequal distances from the intercubiti; cells; the small second cubital almost petiolate; pterostigma brown; hamuli eleven.

Locality.—Sandringham, Victoria, 21st February, 1950, leg. Rayment.

Type in the collection of the National Museum of Victoria.

Allies: Close to *S. relucens*, but larger, and separated by the spoonlike short mandibulae and the carina on the clypeus.

Sericophorus castaneus, sp. nov.

Type, female.—Length 6 mm. approximately. Blue, with reddish abdomen.

Head bluish, closely punctured; face in certain lights with much appressed white hair; frons with a median sulcus; clypeus rugose, anterior margin with two teeth, inner one largest; supraclypeal area depressed; vertex with white hair; compound eyes with anterior margins parallel; genae with considerable white hair, sericeous; labrum amber; mandibulae amber, darker, basally, red apically; antennae with bluish scapes; flagella missing on specimen.

Prothorax blue, with a line of white hair; tubercles blackish, with a fringe of white hair, mesothorax with close punctures of large size; scutellum similar, but more shining; postscutellum darker, with closer punctures, and white hair; metathorax more shining, with huge rugae (refer to plate); considerable white hair on dorsum; abdominal dorsal segments of a rich castaneous colour; hind margins amber; considerable white hair; pygidial plate with coarse spines of medium length; ventral segments similar, but with less hair.

Legs redder, femora, trochanters and coxae bluish; tarsi red; anterior tarsal comb with six long strong spines; claws red; hind calcar red; tegulae bluish basally, otherwise piceous; wings brownish; nervures pale-amber, second recurrent closer to second intercubitus; cells normal for the genus; pterostigma very pale, with amber margin.

Locality.—Brisbane, Queensland, 12th February, 1918, leg. H. Hacker.

Type in the collection of the Queensland Museum.

Allies: Close to *S. brisbanensis*, which has one clypeal tooth; these may be the two sexes.

Sericophorus chalybaeus Sm. stat. nov.

Ann. Mag. Nat. Hist., (2) VII., p. 32, 1851

Female.—Length 10 mm. approximately. Dull steely-blue, red legs.

Head transverse, sericeous; face with a few white hairs; frons without a distinct swelling; clypeus with the anterior margin slightly convex, with three small nodular teeth laterally, very coarse punctures; supraclypeal area not defined; vertex with ocelli set in small excavations, some black hair; compound eyes reniform, anterior margins practically parallel; genae clothed with silvery pile; labrum ferruginous; mandibulae ferruginous, margined and tipped with reddish-black; antennae with scapes and pedicel black, flagellum ferruginous, a black dot apically.

Prothorax shows as a fine line of white hair; tubercles bluish, with a fringe of white hair; mesothorax metallic-blue, sericeous, a few black hairs (in this genus the short medioscutal furrows are flanked on either side by shining short lines, and the position of the parapsidal "furrows" is indicated by raised lines); scutellum blacker, and sub-tuberculate; postscutellum with larger punctures; metathorax more bluish, dorsum of epinotum microscopically rugose, with six transverse carinae at sides below; abdominal dorsal segments with numerous piliferous punctures, pygidial plate dark, with long fine spines; ventral segments with a few black hairs.

Legs dull-reddish, the coxae, trochanters and femora basally bluish; tarsi red, anterior tarsal comb with six spines; claws red; hind calcar darker red; tegulae blackish-brown; wings subhyaline; nervures blackish, the first recurrent far distant from the first intercubitus; cells normal for the genus; pterostigma large, blackish; hamuli fourteen.

Locality.—"New Holland" collector not known. Daylesford, Victoria, 23rd January, 1948, leg. "B.G." Wannon, Victoria, 11th January, 1948, leg. "B.G."

Females in the collections of A. N. Burns, Rayment, and male in National Museum, Melbourne.

A female, larger than the type, with the lateral carinae of the epinotum quite inconspicuous, and dorsum smoother, with many finer punctures; the striae are obsolete; the black tubercle of the scutellum is very conspicuous; apical third of the femora red. This may be separated when the male is known. Leura, Blue Mountains, New South Wales, 24th January, 1903, leg. W. W. Froggatt.

Two males taken with several females at the same time and place, and associated by the collector, is apparently the undescribed sex of *S. chalybaeus* Sm. It is only a trifle larger than the male of *S. cliffordi* Raym., and could easily be mistaken for it. It can, however, be distinguished by the following comparison:—

S. cliffordi has considerable white hair on the face, and the tarsi are reddish throughout. *S. chalybaeus* has little or no white hair on the face, and it has black tarsi, with the fifth bright ferruginous in strong contrast.

The third cubital cell is greatly contracted at the top in *S. cliffordi*, but hardly at all in *S. chalybaeus*. The author was fortunately able to study the genitalia of *chalybaeus*. Both sexes taken on flowers of *Leptospermum scoparium*.

Gorae West, Victoria, 27th December, 1951, leg. Clifford W. Beauglehole. Gorae West, Victoria, 9th January, 1952, leg. Clifford W. Beauglehole. Allotype in the collection of the National Museum of Victoria.

One of the wasps was on the ground, and close at hand was a prismatic-purple mutillid, which is probably parasitic on these wasps, for mutillids were taken by the author from shafts in Sandringham. (See pl. 6, Nos. 8 and 9 for details of genitalia.)

Gorae West, Victoria, 23rd December, 1950, A. Cliff. Beauglehole.

Allies: *S. sydneyi* Raym., which is a greener, slightly smaller species; *S. cliffordi* Raym., which is of the same colour, but a trifle smaller.

Smith says his specimen is unique in the collection of the British Museum.

Sericophorus chalybaeus fulleri, subsp. nov.

This female may be separated by the following characters, and is best described by comparison.

<i>Subspecies.</i>	<i>Species.</i>
Duller, rougher.	Brighter, smoother.
Slightly larger, robust.	Smaller, slender.
Ocelli larger.	Ocelli smaller.
Clypeal teeth larger, truncate.	Clypeal teeth smaller, acute.
Mandibles reddish.	Mandibles amber.
Anterior orbital margins parallel.	Slightly converging above.
Head wider.	Head narrower.
Mesothorax duller, punctures shallower.	Mesothorax brighter, punctures deeper.
Scutellum duller.	Scutellum brighter.
Tubercle compressed.	Tubercle mammiform.
Dorsum shining between larger punctures.	Dorsum duller between finer punctures.
Cruciform structure more defined.	Structure less defined, eight rugae laterally.
Punctures of abdomen not so close.	Punctures closer, and rougher between.
Tarsal comb of seven spines.	Tarsal comb of six spines.
First recurrent far distant.	Recurrents equidistant from intercubiti.
Wings lighter.	Wings darker.
Third cubital cell hardly narrower at top.	Third cubital cell somewhat contracted at top.

Locality.—Blundells, 20 miles west of Canberra, 19th January, 1936, leg. M. E. Fuller.

Type in collection Division of Entomology, C.S.I.R.O., Canberra, A.C.T.

Sericophorus claviger (Kohl.) stat. nov.

Ann. K. K. Hofmus, Wien, VII., pp. 197-234, 1892

Female.—Length, 7.5 mm. approximately. Greenish-blue.

Head transverse, with numerous large punctures; face with considerable white hair; frons with a swollen area, and a polished line that broadens as it approaches the ocellus; clypeus black, larger punctures, with the angles of the anterior margin produced to a low nodule; the margin straight between the nodules; supraclypeal area not defined; vertex longer than in other species; compound eyes converge a trifle at top; genae with numerous piliferous punctures and black hair; labrum ferruginous; manibulae ferruginous, dark-red apically; scapes dark; flagellum claviform, ferruginous in certain lights, the two apical segments black, the median segments produced to a node (fast knotig).

Prothoracic collar appears as a mere line; tubercles bluish; mesothorax with a sericeous sculpture, and black piliferous punctures; the scutellum and the postscutellum lack the sericeous sculpture, but are shining, with numerous large punctures (much closer on postscutellum); metathorax with the dorsum of the epinotum finely rugose; abdominal dorsal segments green, with numerous piliferous punctures, apical segments red, the large pygidial plate with fine spines; ventral segments polished.

Legs with coxae, trochanters, and femora basally bluish; tarsi red; claws red; hind calcar red, with darker tips; tegulae piceous; wings hyaline; cells normal for the genus; nervures amber, the distance between the first recurrent

and the first intercubitus is twice as long as the distance between the second recurrent and the second intercubitus; pterostigma amber, with a dark-brown margin; hamuli eleven.

Allies: Kohl stated that *claviger* stands next to *chalybaeus*, Sm., but it is not very close, and is nearer to species such as *spryi*, which is about the same size; *chalybaeus* is a much larger duller insect of an even steely-blue colour. It is probable that the type insect is a male.

A female, not typical, with the anterior margin of the clypeus not straight as in the species, the head only obscurely metallic, and the clypeus shining black.

Locality.—Lane Cove, New South Wales, 25th March, 1934, leg. Norman W. Rodd.

A female, not typical, having dark-brown antennae with black only on apical segment, which is differently shaped.

Locality.—Woollahra, Sydney, New South Wales, 2nd April, 1939, leg. Alex. Holmes.

Taken on flowers of *Kunzia ambigua*.

Two males, typical.

Locality.—Darnum, Gippsland, Victoria, January, 1913, leg. Chas. Oke. Mt. Victoria, New South Wales, 3rd January, 1931, leg. A. N. Burns.

A male, larger, 8.5 mm., with the apical segments of the abdomen red, and the fine rugosity laterally on the dorsum very conspicuous, as is the tubercle on the scutellum. Clypeal punctures in *claviger* are much coarser, almost rugose, head black, the dark apical segments of the antennae are not comprised.

Locality.—Sydney, New South Wales, 8th December, 1918, leg. G. H. Hardy.

Sericophorus claviger burnsiellus, subsp. nov.

Type, male.—This form differs from the species by the black flagellum, the remarkable apical segment of which is compressed laterally (see No. 3, Fig. 2) the mandibles are very dark, and the apical segments of the abdomen black (red in the species); scutellum subtuberculate. When the female is known the subspecies will almost certainly be given specific rank.

Locality.—Chelsea, Victoria, 26th October, 1918, leg. L. Treblecock.

A slightly larger male, with apical segment of flagellum excavated; clypeus with the tooth larger and somewhat hooked; apical segments of abdomen black; five spines on anterior tarsal comb; second recurrent very close to second intercubitus; nervures amber; hamuli eleven.

Locality.—Cavendish, Victoria, 8th January, 1948, leg. "B.G."

A larger male, with apex of abdomen black, apex of flagellum excavated.

Locality.—Lilydale, Victoria, probably collected by the late Frank Spry.

Sericophorus cliffordi, sp. nov.

Type, female.—Length 9 mm. approximately. Dark-blue, red tibiae.

Head sericeous, with considerable silvery hair on lower part of face; many piliferous punctures; frons with a low swelling, and a short fine sulcus; clypeus black, shining, median punctures largest, three clypeal teeth, including that of the angle; vertex with black hairs tipped with white; compound eyes have the anterior margins practically parallel; genae sericeous, with white hair; labrum black; mandibulae shining black, with obscure reddish tint; antennae ferruginous beneath, the three basal segments and modified apical one blackish.

Prothorax much appressed, with silvery hair laterally; tubercles black, small, with a fringe of white hair; mesothorax sericeous, with many piliferous punctures, the black hairs somewhat hooked, with white tips; scutellum subtuberculate, almost black, and very shining, black hair; postscutellum bluer, with closer smaller punctures; metathorax with the stem of the cruciform structure much expanded at base; the dorsum finely rugosopunctate; laterally, about six fine carinae; abdominal dorsal segments sericeous, a dusting of fine white hair; microscopic piliferous punctures; pygidial plate black, with numerous coarse spines; the basal tergum is the widest; ventral segments smoother.

Legs blue-black, femora distally, and tibiae ferruginous-red; tarsi suffused with blackish, except large fifth, which is ferruginous; claws reddish; hind calcariae red; tegulae shining piceous; wings hyaline; nervures blackish-brown, first recurrent farther from the first intercubitus; cells; third cubital hardly contracted at top; pterostigma blackish-brown; hamuli eleven.

Allotype, male.—Length, 6.5 mm. approximately. Dark-blue.

Head sericeous, with numerous piliferous punctures; face with a few white hairs; frons practically without a swelling, but with a fine median sulcus; clypeus black, closely punctured, angle developed to a small triangular tooth; vertex with black hair; compound eyes have anterior margins practically parallel; genae sericeous, with a few silvery hairs; labrum black; mandibulae black, with obscure amber tint; antennae black, slightly modified on apical segments.

Prothorax appressed, a few white hairs laterally; tubercles black; mesothorax scutellum and postscutellum as in the female; metathorax with the dorsum defined by a semicircular ruga; on the whole, the epinotum is more coarsely rugose; abdominal dorsal segments as in the female, the pygidial plate is more rounded, and broader than that of the female, with finer spines; ventral segments more polished.

Legs blue, tibiae bright ferruginous-red; tarsal comb of five spines; tarsi as in female; claws red; hind calcar red; tegulae shining black; wings as in female; hamuli eleven.

Locality.—Gorae West, Victoria, 16th January, 1951, leg. Cliff. Beauglehole. A male, 9th January, 1952, leg. Cliff Beauglehole.

Type and allotype in the collection of the National Museum of Victoria.

Allies: *S. rufotibialis* Raym. is very close, but that male has a red pygidial plate; lacks clypeal teeth, has red mandibulae, and black flagella. It is a larger insect. *S. cliffordi* males, taken at same time and place as males of *S. chalybaeus*, have red femora; *chalybaeus* has blue-black femora.

Although the sexes were not taken in cop, there are the sex differences in the structure of the clypeal teeth and there is little doubt that the sexes are correctly associated. The large serrated process of the genitalia is very distinctive.

One female on *Eucalyptus Kitsoniana*, but both sexes were taken on flowers of *Leptospermum scoparium*. The collector sent the following note—"They have an extremely short stay on the flowers; do what they came for, and quickly disappear."

Sericophorus cyanophilus, sp. nov.

Type, female.—Length, 10 mm. approximately. Bluish-violet, with red legs.

Head transverse, sericeous; face with a few black hairs tipped with white; frons with a short carina; clypeus black, shining, rugose-punctate, anterior margin with three teeth, the outer one very large; supraclypeal area not defined,

but punctures smaller; vertex with ocelli in shallow smooth depressions; compound eyes with anterior margins practically parallel; genae with minute piliferous punctures, and a few white hairs; labrum blackish; mandibulae amber, reddish-black apically; antennae with bluish scapes, pedicel and first segment of flagellum dark-brown.

Prothorax rather stout, with a line of white hair; tubercles blackish, with smoky hair; mesothorax roughly sericeous, the black hair with white curved tips; scutellum black, more shining, with a low mammiform tubercle; post-scutellum shining, closer punctures not smaller; metathorax more violet, with about eight fine carinae laterally, and rugosopunctate with a few white hairs; abdominal dorsal segments violet, with a dusting of white hair, pygidial plate brown, with numerous coarse long spines; ventral segments more shining.

Legs blue, tibiae and knees ferruginous; tarsi brown, fifth ferruginous; anterior comb with seven long strong spines; claws reddish; hind calcar reddish; tegulae piceous; wings subhyaline; nervures sepia, strong, the second recurrent much nearer the second intercubitus; cells normal for the genus; pterostigma amber, with a darker margin; hamuli fourteen of pallid colour.

Locality.—Stanthorpe, Queensland, 4th November, 1914, leg. unknown.

Type in the collection of the Queensland Museum.

Allies: Close to *S. violaceus*, Raym. which is smaller, with ferruginous clypeus, scapes and legs; falls next to *S. lilacinus*, Raym. Compared with *S. chalybaeus* this female has much more white hair on the abdomen, and is larger.

Sericophorus elegantior, sp. nov.

Type, female.—Length 7 mm. approximately. Blue, green abdomen.

Head transverse, bright, almost blackish-green, hair tipped with white; face with a mammiform swelling; frons with a fine carina; clypeus entirely ferruginous, with two large and one small nodular teeth; supraclypeal area not defined; vertex with a little black hair; compound eyes hardly converging above; genae with much white pile; labrum ferruginous; mandibulae ferruginous, with dark-red tips; antennae entirely ferruginous, a black spot on the excavated apical segment.

Prothoracic collar shows as a blackish line, white hair laterally; tubercles blackish, a white fringe of hair; mesothorax bright, subsericeous, purplish-blue, many piliferous punctures, some black hair; scutellum tuberculate, much black hair; postscutellum more closely punctured; metathorax with dorsum of epinotum more rugose, much white hair laterally; abdominal dorsal segments chalybeous, hind margins emerald-green except on one, some ochreous hair, red pygidial plate with many long fine spines; ventral segments polished, with a few golden hairs.

Legs entirely clear light-ferruginous; tarsi similar, anterior tarsal comb with five slender spines; claws pale-ferruginous; hind calcar pale-amber; tegulae amber; wings slightly milky; nervures brown, first recurrent far distant from first intercubitus; third cubital cell contracted at top; pterostigma amber, with a darker margin.

Locality.—Bolgart, Western Australia, March, 1951, leg. Rica Erickson.

Paratype.—Not known, but probably New South Wales, leg. A. N. Burns.

Type in the collection of the National Museum of Victoria; paratype in the collection of A. N. Burns.

Allies: Resembles a very small *S. rufipes* by the clear legs and antennae, but is nearer *S. spryi*, which has dark antennae. It is a handsome though small wasp.

Sericophorus froggatti, sp. nov.

Type, female.—Length, 5.5 mm. approximately. Black.

Head transverse, with an obscure aeneas lustre; face on anterior half with dense silvery appressed hair; frons so excessively densely punctured as to appear granular; clypeus black, with two small nodular teeth (not including the angle); supraclypeal area not defined, and lacking a carina and swelling; vertex long, closely punctured, almost nude; compound eyes converge slightly above; genae with close fine piliferous punctures, and short white hair; labrum amber (insect is carded, and clypeus, &c., difficult to examine); mandibulae ivory-coloured, reddish-amber apically; antennae rather short, submoniliform, black, the apical segments slightly reddish beneath, and tip compressed.

Prothorax black, not closely appressed, with the ivory interrupted line expanded laterally, a few white hairs; tubercles largely ivory-coloured; mesothorax black, bright, with close piliferous punctures of medium size, a few appressed white hairs; scutellum and postscutellum similar; metathorax all black, with a long enclosed area and a fine median carina, the dorsum is finely rugosopunctate, some white hair laterally; terga black, bright, with fine piliferous punctures, and a dusting of appressed silvery hair, two, three, and four with pallid margins; caudal plate black, with thick short black spines; ventral segments black, with white hair.

Legs ferruginous-red, an ivory-coloured spot distally on anterior and median femora, coxae and trochanters blackish; tarsi red; pulvillus small and black; hind calcar straw-colour; tegulae palest-amber; wings hyaline; nervures amber, recurrents far distant from the intercubiti; small second cubital forming almost an equilateral triangle; pterostigma amber; hamuli nine, pallid.

Locality.—Mittagong, N.S.W., 12th January, 1902, leg. W. W. Froggatt.

Type in the collection Department of Agriculture, New South Wales.

Allies: The enclosed area of dorsum resembles that of the larger *S. pescotti* Raym., but it is definitely distinct. These two species could almost be included in *Anacrucis* but for the enclosure.

Sericophorus gracilis, sp. nov.

Type, female.—Length, 9 mm. approximately. Dull-blue.

Head sericeous, transverse, with a sprinkling of white hair; frons with a fine carina that reaches the median ocellus; clypeus black, prominent, closely punctured, anterior half rugose with three teeth; (supraclypeal area is not defined in the genus); vertex with some black and white hair intermixed; compound eyes reniform; genae with a few white hairs; labrum black; mandibulae dark-red, black basally; antennae with scape and pedicel black, flagellum rufous, apical segment black.

Prothorax not so appressed as in *teliferopodus*; tubercles blackish, with a fringe of white hair; mesothorax slightly greener; scutellum blackish-blue, punctures larger and wider apart; sub-tuberculate; postscutellum with closer punctures; metathorax more purple, shining, a number of transverse carinae laterally; abdomen very slender apically; abdominal dorsal segments purple, shining, with some white hair laterally; pygidial plate black, entirely covered with long fine spines; ventral segments more shining.

Legs blue, tibiae ferruginous; tarsi dark-blue or black, only fifth ferruginous, anterior armed with a comb of coarse spines as in other species; claws red; hind calcar red basally, black apically; tegulae shining piceous; wings hyaline;

nervures light-brown, first recurrent far short of the first intercubitus; cells; third cubital hardly contracted at the top; pterostigma brown, margined with black; hamuli about eleven.

Locality.—Glen Aplin, Queensland, 11th December, 1945, leg. "A.G."

Type in the collection of A. N. Burns.

Allies: Easily known from all others by its slender form; *chalybaeus* is not close, except in colour.

Sericophorus hackeri, sp. nov.

Type, male.—Length 5 mm, approximately. Blue, with red abdomen.

Head closely and finely punctate; face with white hair on lower part; frons with a small mammiform swelling; clypeus very finely punctate; with angle of convex margin produced to a small sharp tooth; supraclypeal area not defined; vertex without much hair, and no depressions; compound eyes with anterior margins parallel; genae practically nude, closely punctured; labrum dark-red; mandibulae dark-red; antennae with bluish scapes and pedicel, flagellum ferruginous.

Prothorax with little hair; tubercles blackish; mesothorax with finer punctures than in *castaneus*, but rougher, almost rugoso-punctate; scutellum similar; postscutellum with smaller closer punctures; metathorax rugose, but lacking the hexagonal "honey-comb" of *brisbanensis*; abdominal dorsal segments dull-castaneous, with brownish suffusions; a few fine white hairs, pygidial plate paler, with a few long fine spines; ventral segments similar.

Legs blue, tibiae ferruginous; tarsi ferruginous; anterior comb with four spines; claws ferruginous; hind calcar reddish; tegulae pallid; wings with a milky shade; nervures palest-amber, the second recurrent is very close to the second intercubitus, and has a short spur parallel to the cubitus nervure; cells normal; pterostigma pallid, with amber margin.

Locality.—Brisbane, Queensland, 8th February, 1916, leg. H. Hacker.

Type in the collection of the Queensland Museum.

Allies: Close to *S. brisbanensis* and *castaneus*, but sculpture of metathorax very different.

Sericophorus inornatus, sp. nov.

Type, female.—Length, 9 mm, approximately. Bluish with obscure green lustre.

Head transverse, with a green tint, rather smooth, dull sericeous; frons with a few white hairs on anterior portion and a low mammiform rise; clypeus sculptured like the frons, with two large teeth on anterior margin; supraclypeal area similar to the smooth sericeous sculpture of the frons; vertex with a few black hairs; compound eyes converging on the vertex; genae very finely sericeous, with a few white hairs at base; labrum dark-brown, mandibulae amber, dark-red apically; antennae with scapes and pedicel dark, flagellum ferruginous, but apically it shades to dark-brown and black.

Prothorax thicker than in other specimens, with white hair laterally; tubercles black; pleura with blackish hair; mesothorax dull-blue, sericeous, with inconspicuous piliferous punctures, and a few black hairs; scutellum much brighter, with large punctures, and a sharp black tubercle; postscutellum greener, and more shining; metathorax with a greenish tint, and fine transverse rugae very inconspicuous, so that it is minus the coarse rugae of all the other species;

abdominal dorsal segments bluish, and brighter, one produced to a tubercle dorsally, large truncated pygidial plate with short coarse spines; ventral segments polished.

Legs blue, tibiae ferruginous; tarsi ferruginous; claws ferruginous; hind calcar reddish; tegulae dull-piceous; wings hyaline; nervures sepia; cells normal for the genus; pterostigma sepia, with darker margin; hamuli thirteen.

Locality.—Wynyard, Queensland, 1st February, 1916, leg. G. H. Hardy.

Type in the collection of the Queensland Museum.

Allies: Small forms will be mistaken for *S. claviger*, Kohl., which has only one tooth at the sharp clypeal angle.

Known by the inconspicuous rugae of the metathorax.

Sericophorus lilacinus, sp. nov.

Type, female.—Length, 10 mm. approximately. Bluish-violet, red legs.

Head transverse, obscure greenish, sericeous, with white hair; face with no black hair; frons with a mammiform tubercle; clypeus blackish, finely punctured, with much white hair, and three large black teeth; supraclypeal area not defined; vertex with foveae not evident; compound eyes converge only on vertex; genae finely sericeous, with much white hair; labrum reddish-black; mandibulae amber, darker basally and apically; antennae with scape and pedicel brown, flagellum ferruginous.

Prothorax bluish-violet, some white hair laterally; tubercles reddish, with a fringe of white hair; mesothorax very dull-sericeous, but bluer than head, shallow piliferous punctures, and some black hair; scutellum brighter, with an acute black tubercle; postscutellum with closer punctures; metathorax bluer, more shining, with very fine rugae laterally, and some white hair; abdominal dorsal segments shining, with minute piliferous punctures, and a dusting of white hair; pygidial plate brown, with long coarse spines; ventral segments blacker, and polished.

Legs ferruginous, coxae and trochanters blue; tarsi ferruginous, anterior comb with six long coarse spines; claws ferruginous; hind calcar ferruginous; tegulae amber, suffused with blackish; wings subhyaline, yellowish; nervures sepia; cells normal for the genus; pterostigma sepia with darker margin; hamuli eleven.

Locality.—Wynyard, Queensland, 1st February, 1916–17, leg. G. H. Hardy.

Type in the collection of the Queensland Museum.

Allies: Very close to *S. violaceus*, which has a ferruginous clypeus; *S. chalybaeus* Sm., which has blue femora. Annectant between *S. cyanophilus* and *S. violaceus*.

Sericophorus littoralis, sp. nov.

Type, female.—Length, 11 mm. approximately. Dull blackish-blue, red legs.

Head blackish, oily-bright, short white hair, microscopically tessellate, closely punctured; frons with a high compressed tubercle; clypeus closely punctured, convex, shining, anterior margin with two nodular teeth, outer one largest (see pl. 6, No. 15); compound eyes converging above; antennae entirely ferruginous except the black apical segment, which is formed like that at pl. 3, No. 11.

Prothorax with white hair; mesothorax blackish, granular, close shallow punctures, a few short black and white hairs; scutellum blackish, shining, tuberculate, with much larger punctures; postscutellum with smaller punctures; and white hair; epinotum with fine rugae laterally; the dorsum has very fine punctures on a minute tessellation.

Abdomen dull-bluish, white hair, margins very narrowly smoother, pygidium dark-reddish, with long pale spines; legs clear ferruginous, a little blackish on coxae; tarsi ferruginous, pulvillus large; tarsal comb of seven spines; wings slightly yellowish; nervures pale-amber, second intercubitus close to second recurrent; pterostigma amber, with a darker margin; tegulae dark-amber; tubercles reddish.

Locality: Ardrossan, South Australia, 27th November, 1885, leg. Tepper.

Type in the collection of South Australian Museum.

Taken at the base of the cliffs, St. Vincent Gulf.

Allies: Close to *S. sydneyi* Raym., but easily separated by the black nervures. *Sydneyi* has a blue-green head; blackish pygidial plate, and numerous fine striae on the epinotum; approaches *S. chalybaeus*, Sm. which is duller, with greenish-blue head, and greenish-black scapes; three clypeal teeth. *S. viridis* Sauss. is much brighter, and greener, with coppery tints on the abdomen.

Sericophorus metalleseens, sp. nov.

Type, male. Length, 6 mm. approximately. Greenish-blue.

Head sericeous, almost circular from the front; face on lower part with much white hair; frons with a fine black line, and a mammiform swelling; clypeus blackish, with many fine punctures, the angle produced to a large node which appears to be two nodules conjoined; supra-clypeal area not defined; vertex with the ocelli placed more or less in excavations; foveae reduced to two blackish marks; compound eyes converging strongly above; genae microscopically lineate and punctate, with some white hair; labrum blackish; mandibulae reddish-amber, blackish basally and apically; antennae blackish; obscurely brownish beneath.

Prothorax thin, but not so appressed as in other species; tubercles blackish; mesothorax dull-metallic, sericeous, with minute punctures; scutellum much more shining, with larger punctures; postscutellum not quite so bright; metathorax shining, with many transverse and oblique coarse rugae, which it is impossible to describe intelligibly; abdominal dorsal segments shining, bluish-green, with many minute piliferous punctures; pygidial plate blackish, with numerous fine spines; ventral segments more polished, some coarse pale spines apically.

Legs with coxae, trochanters and femora metallic peacock-blue; tibiae amber, more or less suffused with blackish; tarsi piceous, with four coarse spines on the short anterior basitarsus; claws blackish-red; hind calcar blackish-red; tegulae piceous; wings hyaline; nervures brownish, the recurrents equally distant from the intercubiti; cells normal for the genus; pterostigma brown, with darker margin; hamuli nine.

Locality.—Fraser Park, New South Wales, 16th December, 1947, leg. Norman W. Rodd.

Type in the collection of the National Museum of Victoria.

Allies: Approaches *S. patongensis*, Raym., by the structure of the metathorax, and its brighter colour, with three clypeal teeth. It is closest to *S. rugosus*, which has red tibiae and is larger.

Sericophorus minutus, sp. nov.

Type, male.—Length, 5 mm. approximately. Royal-blue, with red legs.

Head transverse, shining, with minute piliferous punctures; face with appressed white hair; frons with a low swelling, and a fine line reaching the median ocellus; clypeus shining black, finely punctured, only the angle developed to an acute corner; supraclypeal area not defined; vertex elevated, with white hair; compound eyes hardly converging above; genae with minute piliferous punctures; labrum amber; mandibulae bluish, amber apically; antennae with black scapes, flagellum ferruginous beneath, apical segment and pedicel black, median segments above suffused with brown, and gradually broadening.

Prothoracic collar closely appressed in the middle; tubercles blackish; pleura sculptured like the mesothorax; mesothorax microscopically tessellate, shining, with close minute piliferous punctures and white hair; scutellum similar; post-scutellum darker, not quite so blue; metathorax darker-blue, shining, dorsum defined by a fine ruga enclosing a rugose reticulation, some white hair laterally, the cruciform structure shining black; a fine rim laterally; abdominal dorsal segments with microscopic piliferous punctures, a light dusting of white hair, the posterior margins broadly amber, the broad pygidial plate blackish, with a few pallid spines; ventral segments more polished.

Legs ferruginous, coxae, trochanters, and anterior femora blue; tarsi orange-ferruginous; anterior comb of five pallid spines; claws ferruginous, pulvillus black; hind calcar pallid; tegulae amber, bluish apically; wings conspicuously milky, very iridescent, with white hair; nervures palest-amber, recurrents equally distant from the intercubiti; cells; second cubital triangular, third cubital not contracted at top, pterostigma pallid, with an amber margin; hamuli six or seven.

Locality.—Twenty miles south-east of Bourke, New South Wales, 27th October, 1949, leg. E. F. Riek.

Type in the collection of the Division of Entomology, C.S.I.R.O., Canberra, A.C.T.

Allies: *S. claviger* by the clypeal teeth; *S. rugosus* by the rugose dorsum; but easily separated by its small size, colour and milky wings. A very beautiful species.

Sericophorus nigror, sp. nov.

Type, female.—Length, 9 mm. approximately. Black, ivory markings.

Head transverse, closely punctured, a sprinkling of white hair; face with a large mammiform tubercle; frons closely punctured; clypeus with four ivory-coloured patches, and a median high longitudinal carina, much appressed silvery hair, anterior margin with three nodular teeth; vertex closely punctured; compound eyes converging above; genae closely punctate, with white hair; labrum blackish-red; mandibulae ivory, black tipped; antennae black, scapes short and stout; flagellum with a reddish tint in some lights.

Prothorax black, with two ivory lines on a bracket-shaped upper margin; tubercles ivory-coloured; mesothorax black, shining, closely punctate, not sericeous; scutellum similar; postscutellum more closely punctured; metathorax closely diagonally rugoso-punctate at sides of the cruciform structure, some white hair at base; abdominal dorsal segments black, closely punctate, hind margins broadly depressed, pygidial plate brown, with short fine spines; ventral segments polished, with brown margins.

Legs blackish to piceous, tibiae with an ivory stripe; tarsi brownish, anterior with a comb of coarse spines; claws ivory, with red tips, simple; hind calcar pale-amber; tegulae brown, with an ivory spot; wings subhyaline; nervures with

with the two recurrents equally distant from the intercubiti, so that the triangular small second cubital receives the second recurrent at about its middle; cells normal for the genus, a small appendiculate cell; pterostigma and nervures light-brown; hamuli fourteen.

Locality.—Lucindale, South Australia, 28th February, 1911, leg. Fr. Seeker.

Type in the collection of the South Australian Museum.

Allies: Not close to any described species, but approaches *S. relucens* Sm. by the ivory markings; easily known by the large frontal swelling and black colour.

Sericophorus niveifrons, sp. nov.

Type, female.—Length, 7 mm. approximately. Blue, with red legs.

Head blackish, shining, closely punctured; face with much silvery hair; frons with a low mammiform swelling, and a fine line that reaches the median ocellus; clypeus with a large red median mark, closely punctured, rugose anteriorly; anterior margin with two small teeth; supraclypeal area not defined; vertex with a few white hairs; compound eyes converging slightly above; genae with microscopic punctures and much white hair; labrum red; mandibulae ferruginous, darker apically; antennae orange-ferruginous, sub-clavate.

Prothoracic collar thicker laterally; tubercles blackish, with a fringe of white hair; mesothorax smooth, shining, closely punctured, with white hair; scutellum and postscutellum similar; metathorax with dorsum smooth, microscopic piliferous punctures, a few white hairs, the dusting of white hair is more evident along the scutellar suture; cruciform structure deep, shining, about eight short coarse rugae laterally; abdominal dorsal segments more finely punctured than the mesothorax, pygidial plate brown, with long fine spines; ventral segments more polished.

Legs ferruginous-red, only the coxae and trochanters blue; tarsi red, anterior comb of six spines; claws ferruginous; hind calcar ferruginous; tegulae bright, yellowish-amber; wings slightly milky, with white hair; nervures palest-amber, first recurrent far distant from first intercubitus; cells normal for the genus; pterostigma pale-amber, with a darker margin; hamuli nine.

Locality.—Five miles north of Nocatunga, Queensland, 13th November, 1949, leg. E. F. Riek.

Type in the collection of the Division of Entomology, C.S.I.R.O., Canberra, A.C.T.

Allies: *S. elegantior*, which is larger, with much coppery hair apically on the abdomen, and coarse punctures on dorsum of metathorax. A beautiful species.

Sericophorus occidentalis, sp. nov.

Type, female.—Length, 10 mm. approximately. Purple, light-ferruginous legs.

Head black, tessellate, with close punctures; face with sparse white hair; frons with a large compressed tubercle; clypeus clear-ferruginous, closely punctured, with two large teeth on anterior margin; supraclypeal area depressed; vertex shining, with considerable white hair; compound eyes with anterior margins parallel; genae very finely punctured, with a few white hairs; labrum and mandibulae clear-ferruginous, the latter with dark-red tips; antennae clear-ferruginous, rather short.

Prothorax deeply impressed, some white hair laterally; tubercles black, with smoky hair; mesothorax finely tessellate, numerous punctures of medium size, a few short black hairs; scutellum purple (black in *S. violaceus* Raym.), with a large tubercle; postscutellum brighter, with a greenish tinge, closer punctures; metathorax more iridescent purple, dorsum smooth between the smaller punctures, shaft of the cruciform structure very wide, six large lateral carinae, and white hair; abdominal dorsal segments with a cerise lustre, closely and finely punctured, hind margins depressed and reddish-amber, white hair, apical segments clear-ferruginous, together with the pygidial plate; ventral segments similar (darker in *S. violaceus*).

Legs entirely clear-ferruginous; tarsi clear-ferruginous, anterior comb of seven spines; claws ferruginous; pulvillus not very large; hind calcar ferruginous; tegulae amber; wings hyaline; nervures sepia, first recurrent far distant from the first intercubitus; cells normal for the genus; pterostigma amber, with dark margin; hamuli strong, eleven.

Locality.—Narrogin, Western Australia, leg. A. M. Douglas.

Type in the collection of the Western Australian Museum.

Allies: Very close to *S. violaceus* Raym., which is more shining, less hairy, and bluer, with larger punctures on the dorsum of the metathorax; posterior margins of terga not lighter. A series of nine females showing no variation.

Sericophorus patongensis, sp. nov.

Type, female.—Length, 8 mm. approximately. Bluish-green.

Head transverse, with much white hair, sericeous, face shining; frons with a swelling, and a long carina; clypeus green, closely punctured, with three large black teeth; supra-clypeal area not defined; vertex depressed around the ocelli; compound eyes converge above; genae with much white hair; labrum brownish; mandibulae ferruginous, with dark-red tips; antennae submoniliform, brownish, with ferruginous tints in certain lights; apical segment with a compressed area.

Prothorax greenish-blue, not excessively appressed, some white hair; tubercles blue, with white hair; mesothorax of a beautiful lustrous peacock-blue, sericeous, some white hair; scutellum similar, but with black hair; postscutellum with white hair; metathorax of the same beautiful blue, a few punctures, and many large rugae (see fig. 3, No. 6); abdominal dorsal segments duller and greener, but very smooth, with fine piliferous punctures, a dusting of white hair, pygidial plate brown, with fine long pallid spines; ventral segments polished.

Legs lustrous metallic-blue, tibiae brown, anterior with a ferruginous stripe; tarsi brownish, fifth and pulvillus large, anterior comb with six spines; claws brown; hind calcar long and brown; tegulae blackish, dull; wings hyaline; nervures brown; cells normal for the genus; pterostigma brown; humuli ten.

Locality.—Patonga, New South Wales, 9th March, 1941, leg. Norman W. Rodd.

Type in the collection of Norman Rodd.

Allies: *S. rugosus* and *S. metallescens*, but the insect had a superficial resemblance to *S. spryi* and *S. claviger*.

Sericophorus pescotti, sp. nov.

Type, female.—Length, 7 mm. approximately. Black, red legs.

Head transverse, densely covered with appressed scale-like straw-coloured hair, with many fine white curved white hairs rising above it; frons with a carina joining clypeus and median ocellus; clypeus with the anterior margin bracket-shaped with two small nodular teeth; supra-clypeal area not

defined; vertex comparatively long, microscopically finely rugoso-punctate; compound eyes converging slightly above; genae with the close-set appressed hair of the face; labrum black; facial foveae reduced to blackish-purple marks; mandibulae ivory to amber, dark-red apically; antennae black, segments broader than long, a reddish shade beneath.

Prothoracic collar with two ivory bands and some white hair; tubercles ivory, with a fringe of white hair; mesothorax has the large punctures almost contiguous; scutellum and postscutellum sculptured like the mesothorax; metathorax with the dorsum margined with a fine sharp rim, the enclosed area rugose, the cruciform incisure reduced to a circular pit, laterally the epinotum is margined with another sharp carina; abdominal dorsal segments black, with close piliferous punctures, and much appressed white hair, pygidial plate black, with numerous short stout spines; ventral segments polished black.

Legs dull-red, anterior and median femora with an ivory mark distally; tarsi red; claws dark-red; hind calcar amber; tegulae reddish-amber, with an ivory spot; wings hyaline; brown nervures typical for the genus, the recurrents equally distant from the intercubiti; cells normal; pterostigma dark-brown.

Type, locality.—Sandringham, Victoria, 21st February, 1950, leg. Rayment. One female. Brisbane, Queensland, 8th February, 1916, leg. H. Hacker.

Type in the collection of the National Museum of Victoria.

Allies: Annectant between *S. nigror* Raym., and *S. relucens* Sm.

THE RELUCENS COMPLEX

Large series of females from all parts of Australia have been investigated in this research, but no male was available, and it is clear that *S. relucens* Sm. constitutes an exceedingly difficult complex for the taxonomist. Perhaps if all the males were known a solution of the problem might be found in the genitalia.

Critical study showed a considerable variation in size, from 5 mm. to 10 mm. in length; typical specimens measure only 7 mm.; females from Cooper's Creek, South Australia, are over 10 mm., and the variation in size is not due to nutritional factors.

The colouring is very similar throughout the large series; the tubercles, scutella and legs being red or ferruginous, and the rest of the insects black. The Cooper's Creek specimens have the scutella suffused with black, and so approach *S. pescotti*, Raym., which has an entirely black scutellum. Most have close appressed metallic ochreous hair, though in certain specimens the hair is silver. Others have the hind margins of the abdominal terga broadly amber, while some are entirely black.

The wasps may be long and exceedingly slender, or they may be short and robust. There are differences in structure; some have the mammiform swelling on the frons, and others lack this character; the prothoracic collar varies from thin to thick; anterior margin of the clypeus may be straight or slightly convex; the compound eyes may converge strongly, or the margins may be almost parallel.

There are differences in the cruciform structure, and the epinotum, and the neururation of the wings; the recurrents may be far from the intercubiti, or near.

As no better plan for specific separation appears to be available, the author concludes that, until a series of males is available, it is less confusing to refer all these forms to the widely distributed species, *S. relucens*, Sm., with two easily determined new subspecies, *S. relucens ruficornis* and *S. relucens nigricornis*.

Sericophorus relucens Smith. stat. nov.

Cat. Hym. Brit. Mus., IV., p. 357 (N.3), 1856

Female.—Length, 7 mm. approximately. Black, red legs.

Head transverse, closely punctured, clothed with appressed silvery hair; face with a swollen area; frons with a short fine carina; clypeus convex, closely punctured, with three minute nodules; supraclypeal area not defined; vertex with foveae reduced to small purplish marks; compound eyes converging above; genae closely punctured, with much white hair; labrum black; mandibulae dull-amber, black basally and apically; antennae black, claviform, articles not at all "knotted."

Prothoracic collar reddish, with two ivory bands; tubercles reddish; mesothorax black, excessively closely punctured, appressed white hair; scutellum and postscutellum red, closely punctured; metathorax with dorsum of epinotum excavated posteriorly, much white hair laterally; abdominal dorsal segments black, one polished, with scattered fine punctures; others much more closely punctured, hind margins broadly amber, three and four almost banded with white hair; pygidial plate brown, with short thick spines; ventral segments similar. There is no angular tooth laterally on epinotum.

Legs red, coxae and trochanters black, anterior tarsal comb with six strong spines, tarsi suffused with blackish; claws red; hind calcar amber; tegulae reddish; wings hyaline; nervures reddish-brown, first recurrent far distant from the first intercubitus; cells normal for the genus, third intercubitus not contracted at top; pterostigma reddish-brown; hamuli twelve, weak.

Locality: (Topotype) Adelaide, South Australia, leg. N. B. Tindale. Hawkesbury River, New South Wales, leg. A. N. Burns, 31st December, 1930.

Typical specimens in the collection of A. N. Burns, and South Australian Museum, Adelaide.

Allies: (See discussion.) Easily separated from *S. pescotti* Raym., which has a black scutellum, and *S. carinatus* Raym. which has a carina on the clypeus.

Two typical females—topotypes—no lateral tooth on the epinotum; calcar straight. Adelaide, South Australia, February, 1938, leg. Rayment.

One female, almost typical, but darker flagellum. Sandy Creek, South Australia, January, 1940, leg. H. Womersley.

Two females, carded, eyes hardly converging on vertex. McDonald Ranges, Central Australia, September, 1907, leg. "Wallace."

Several large slender females, three nodes on clypeus; the coloured parts ferruginous; posterior margin of tergites light-amber; epinotum minus the lateral angle; recurrents equidistant from the intercubiti, that is, the small triangular second cubital cell receives the second recurrent at about its middle; hind calcar very curved. Darwin, Northern Territory, leg. Gerald F. Hill.

Two females, "taken while catching flies on sheep." Milroy, New South Wales, 20th November, 1913, leg. Cameron.

One typical female, "catching flies on sheep." New South Wales, probably W. W. Froggatt, or Cameron.

One female, with black flagellum. Badja, east of Bredbo, New South Wales, October, 1933, leg. M. E. Fuller.

One female, annectant between *relucens* and *nigricornis*. Marrakai Station, Northern Territory, 28th July, 1929, leg. Messrs. Mackerras and Campbell.

One female, dark anterior legs, scutella very dark-red, and two basal segments of abdomen highly polished; annectant between *relucens* and *ruficornis*. "Taken while capturing flies around cattle." Westmorland Station, North Queensland, 15th May, 1936, leg. "Seamer."

One female, annectant between *relucens* and *ruficornis*. Brock's Creek, Northern Territory, 18th April, 1929, leg. T. G. Campbell.

One female, annectant between *relucens* and *nigricornis*, the hind margins of the terga are quite black. Brisbane, Queensland, 8th January, 1905, leg. Froggatt collection.

One female, typical in all characters except that the hair of the abdomen is entirely white. Wyndham, Western Australia, 3rd December, 1929, leg. T. G. Campbell.

Two females, typical. Thirty-five miles south of Nappamerry, south-west Queensland, 5th November, 1949, leg. E. F. Riek.

One female, typical. Pinjarra, Western Australia, 9th April, 1950, leg. J. A. Mahon.

A typical female, except for pale-amber tegulae, and the recurrents equally distant from the intercubiti. Swan River, Western Australia, leg. S. Clark.

A female, not typical, having black mandibles and tegulae. Bribie Island, Queensland, leg. probably H. Hacker.

One small female, with the light parts ferruginous, with some yellowish-ivory; three teeth on the clypeal margin; broad bands of amber on the abdominal terga; recurrents far distant from the intercubiti; short thick sparse spines on the pygidial plate; epinotum minus the lateral nodes; the six spines of the anterior tarsus much coarser. These forms might be accepted as typical of the species. Bitter Springs, Darwin, Northern Territory, leg. Gerald F. Hill.

The following specimens, in the collection of the Agricultural Department of New South Wales, were studied by the courtesy of the Chief Entomologist, Mr. T. McCarthy:

One small female, headless, but it appears to be a typical specimen otherwise. Milthorpe, New South Wales, 12th March, 1942, leg. N. S. Lloyd.

One small female, typical in all characters. National Park, New South Wales, 10th December, 1909, T. McCarthy.

One female, typical. Bain?, New South Wales, 5th February, 1931, leg. "W.T.N."

Two females, approaching *nigricornis* by the entirely black antennae. Bathurst, New South Wales, January, 1939, leg. W. C. Lloyd.

Two females, typical, "taken on flowers of *Eucalyptus* sp." Sydney, New South Wales, 26th February, 1902, leg. "W.B.G."

Three females, with bright-red caudal plate, not quite typical. "Taken while catching flies on sheep." Milroy, New South Wales, 20th November, 1913, leg. Cameron.

Two females, typical, Hawkesbury Agricultural College. Richmond, New South Wales, 12th January, 1931, leg. W. Duggan.

One female, typical. Richmond, New South Wales, 2nd December, 1902, leg. W. W. Froggatt.

Two females, annectant between *relucens* and *ruficornis*. Richmond, New South Wales, 2nd December, 1902, leg. W. W. Froggatt.

One large female, approaches *nigricornis*. Chatswood, New South Wales, 2nd November, 1931, leg. Sawkins?

One female, typical. Springwood, New South Wales, 2nd November, 1931, leg. Sawkins?

One female, red parts very bright, caudal plate brown; there are only two cubital cells in the wings; the second intercubitus nervure obsolete. Milroy, New South Wales, 20th November, 1914, leg. Cameron.

A large female, 10 mm. in length, approaching *nigricornis*. Richmond, New South Wales, 2nd December, 1902, leg. W. W. Froggatt.

A typical female. Richmond, New South Wales, 21st January, 1931, leg. J. R. Fisher.

One large female, annectant between *relucens* and *ruficornis*. Cowra, New South Wales, January, 1930, leg. ———.

A female. Wagga, New South Wales, 10th February, 1931, leg. W. Duggan.

Sericophorus relucens nigricornis, subsp. nov.

Female, length, 8–9 mm. in length; abdomen broad, ovate, the red parts often suffused with blackish. Clypeus frequently carinate, anterior margin black, with three small teeth; face with much silvery hair, which sometimes entirely masks the clypeus; antennae black; epinotum with a conspicuous lateral tooth; apical segment somewhat compressed and acute; abdominal terga entirely black, or else showing the merest amber line on the posterior margin; there is a little white hair; apical segment and pygidial plate dark, with short thick dark spines; first recurrent farther distant from the first intercubitus.

A mutation has a peculiar development of the antennal segments (see No. 6, fig 6). The general aspect is blacker, more shining, with less hair.

Locality.—Twenty-five miles east of Durham Downs, South-west Queensland, 11th November, 1949, leg. E. F. Riek.

Cotypes in the collection of the Entomological Division, C.S.I.R.O., Canberra, A.C.T.

One female, near *nigricornis*, but has clypeus nude. Lake Meran, Victoria, 15th December, 1946, leg. R. Trebilcock.

One female annectant between *relucens* and *nigricornis*. Victoria Valley, Victoria, 26th February, 1949, leg. Bruce Given.

Three females, with lateral tooth of the epinotum very large; annectant between *relucens* and *nigricornis*. Kerang, Victoria, 21st December, 1916, leg. R. Trebilcock.

One female, annectant between *relucens* and *nigricornis*. Hawkesbury River, New South Wales, 31st December, 1930, leg. A. N. Burns.

One female, annectant between *relucens* and *nigricornis*. Westwood, Central Queensland, 28th November, 1923, leg. A. N. Burns.

A series of 22 large females, collected over several years. Brisbane, Queensland, 1912–15–16–22, leg. H. Hacker.

Several females. Darwin, Northern Territory, leg. W. K. Hunt.

One female, annectant between *relucens* and *nigricornis*. Richmond, New South Wales, 2nd December, 1902, leg. W. W. Froggatt.

One female, very slender abdomen, annectant between *relucens* and *nigricornis*. Hay, New South Wales, 13th January, 1916, leg. W. W. Froggatt.

Twenty-three females (taken from blowfly trap). Black Mountain, Canberra, A.C.T., 2nd February, 1931, leg. I. J. Mackerras.

One female, Badja, east of Bredbo, New South Wales, October, 1933.

Three females, not typical, and remarkable for having the dorsum surrounded by a pitted sulcus. Thirty-three miles west of Kihee, South-west Queensland, 12th October, 1949, leg. E. F. Riek.

One female. Yanko, South-west Queensland, 8th November, 1919, leg. E. F. Riek.

One female, dorsum defined by a pitted sulcus; these appear to be related to the Kihee specimens, and perhaps should be separated as a subspecies. Forty miles west of Bourke, New South Wales, 28th October, 1949, leg. E. F. Riek.

Two females, Twenty miles south of Milparinka, New South Wales.

Two large females, annectant between *relucens* and *nigricornis*. Thirty-five miles south of Nappamerry, South-west Queensland, 5th November, 1949, leg. E. F. Riek.

Large robust female; epinotum lacks the lateral angular tooth; apical margin of segments of abdomen red; mandibles and antennae black; three nodules on clypeal margin, annectant between *relucens* and *nigricornis*. Kuranda, North Queensland, leg. P. Dodd.

Small robust female, legs almost black, annectant between *relucens* and *nigricornis*. Kerang, Victoria, 17th January, 1947, leg. R. Trebilcock. Kerang, Victoria, 11th December, 1946, leg. R. Trebilcock.

Numbered specimens are in the collection of the Western Australian Museum; the dates are not indicated on the labels.—

One large typical female. Tunney, Western Australia, No. 33-362, leg. A. M. Douglas.

Two large females. Wickopin, Western Australia, No. 33-206 and No. 33-205, leg. A. M. Douglas.

One large female. Subiaco, Western Australia, March, 1913, No. 6969, leg. A. M. Douglas.

Sericophorus relucens ruficornis sub-sp. nov.

These females are longer, 10 mm. in length, and very slender when compared with *nigricornis*; the reddish colour tends to become ferruginous. Clypeal region nude, with three small nodular teeth on the anterior margin, which is somewhat reddish; the clypeus is never carinate; in typical specimens the scape as well as the flagellum is ferruginous; scutellum, post-scutellum, tubercles, tegulae, and legs all ferruginous-red; a small tooth laterally on the epinotum; pygidial plate redder, with longer, paler, finer spines; the posterior margins of the terga broadly ferruginous; and there is much ochreous and golden hair; nervures of wings pale-amber, recurrent nervures equally distant, and far from the intereubiti. Seven spines on the anterior tarsal comb.

Locality:—Type specimen, Tennants Creek, Central Australia, leg. J. F. Field, Darwin, Northern Territory, leg. W. K. Hunt.

Type in the collection of the South Australian Museum.

- Two females, typical except for the dark scape. The Springs, Westmoreland Station, North Queensland, 30th September, 1930, leg. T. G. Campbell.
- One female, not quite typical, annectant between *relucens* and *ruficornis*. Cunnamulla, Queensland, October, 1941, leg. A. J. Turner.
- Two females, not quite typical, having a darker scape. Bribie Island, Queensland, November, 1918, leg. H. Hacker.
- Several typical females. Cooper's Creek, Central Australia, leg. J. G. Reuther.
- Small slender female, apical segments of abdomen very red, antennae ferruginous. Lake Neran, Victoria, 1st February, 1947, leg. R. Trebilcock.
- Several females, long and slender, with three large clypeal teeth, apical segments of abdomen very red, excessively hairy, incisure of epinotum very different. Queensland, 20th August, 1899, leg. Dr. Symons.
- A small slender female, teeth large, red nearer ferruginous. Queensland, August, 1889, Dr. Symons per Dr. Stirling.
- A slender female, very hairy, three small clypeal teeth, reddish parts light-ferruginous, terga broadly amber, epinotum different, annectant between *relucens* and *ruficornis*. Owieaniana, South Australia, leg. Messrs. Hale and Tindale.
- A robust female, light parts all light—ferruginous. Sandy Creek, South Australia, January, 1940, leg. H. Womersley.
- A similar female, with the apical half of the abdominal terga amber. Allendale, South Australia, collector unknown.
- One female, annectant between *relucens* and *ruficornis*. Lake Meran, Victoria, 1st February, 1947, leg. R. Trebilcock.
- One female, annectant between *relucens* and *ruficornis*. Brisbane, Queensland, 12th February, 1912, leg. H. Hacker.
- Two females, annectant between *relucens* and *ruficornis*. Forest River, North-west Australia, leg. W. Crawshaw.
- Three females, with large lateral tooth on metathorax, annectant between *relucens* and *ruficornis*. Thangoo, south of Broome, Western Australia, leg. I. M. Makerras, 4th September, 1934.
- One female, annectant between *relucens* and *ruficornis*. The Springs, Westmoreland Station, North Queensland, 30th September, 1930, leg. T. G. Campbell.
- One female, annectant between *relucens* and *nigricornis*. Bathurst, New South Wales, 3rd February, 1931, leg. E. G. Hall.
- One female, not typical by the broadly rufous posterior margins of abdominal terga. A very old specimen in confusing condition. Roseville, New South Wales, 28th October, 1931, leg. ———.
- Numbered specimens are in the collection of the Western Australian Museum; dates are not indicated on the labels.—
- One small female, annectant between *S. relucens* and *ruficornis*. Narrogin, Western Australia, No. 37-3942, leg. A. M. Douglas.
- One small female, annectant between *S. relucens* and *ruficornis*. Wickepin, Western Australia, No. 33-203, leg. A. M. Douglas.
- One small female, annectant between *S. relucens* and *ruficornis*. Wandagee, Western Australia, No. 37-2338, leg. A. M. Douglas.
- One small female annectant between *S. relucens* and *ruficornis*. South Perth, Western Australia, January, 1916, leg. A. M. Douglas.
- Two females annectant between *S. relucens* and *ruficornis*. Salmon Gums? Western Australia, Nos. 41-55 and 40-313, leg. A. M. Douglas.

Sericophorus rufobasalis, sp. nov.

Type, male.—Length 6 mm. approximately. Black, red legs.

Head transverse, densely covered with appressed silvery hair; face finely rugoso-punctate; frons with a low mammiform swelling; clypeus closely punctured, with the clypeal angle inconspicuous, and not produced to a tooth; supraclypeal area not defined; vertex with the eyes converging slightly, compound eyes large; genae practically the same as the rest of the head; labrum small, black; mandibulae amber, with dark tips; antennae short, submoniliform, black beneath, amber above, segments wider than long.

Prothorax black, suffused with reddish, but has a yellowish line; tubercles ferruginous; mesothorax excessively closely punctured; scutellum and post-scutellum red, punctures larger on the former; metathorax with the stem of the cruciform incisure widest, much white hair, a large lateral tooth; abdominal dorsal segment one red, polished (some specimens have a median black patch), other segments black, margins broadly amber, much appressed white hair, finely and closely punctured, pygidial plate with long pallid spines; ventral segments polished.

Legs ferruginous-red; tarsi red, anterior tarsal comb with six fine amber spines; pulvillus not excessively developed; claws red; hind calcar pale-amber; tegulae amber; wings brownish; recurrent nervures equally distant from the intercubiti, basal straight; second cubital cell triangular; pterostigma brown, darker margin; hamuli about thirteen.

Allies: Probably derived from *S. relucens* Sm., but easily separated by its small size and red basal segment; the absence of clypeal teeth is a sex character.

Type in the collection of the Queensland Museum.

Cotypes in the collection Entomological Division, C.S.I.R.O., Canberra, A.C.T.

Locality.—Brisbane, Queensland, October, 1915-16, leg. H. Hacker.

Typical male. Females with red maculae on base of abdomen may be the other sex. Cairns, Queensland, leg. A. M. Lea.

Seven typical males with basal segment very red. Bourke, New South Wales, 27th October, 1949, leg. E. F. Riek.

One male, typical in all characters. Twenty-five miles east of Tibooburra, New South Wales, 1st November, 1949, leg. E. F. Riek.

One male, typical in all characters. Brisbane, Queensland, 8th January, 1935, leg. probably H. Hacker.

One male, typical in all characters. Badja, east of Bredbo, New South Wales, October, 1933, leg. M. E. Fuller.

A series of ten males, topotypes. Brisbane, Queensland, 26th October, 1910, leg. H. Hacker.

The following specimens are in the collection of the Agricultural Department of New South Wales:—

One male, 8 mm. in length, larger than the type, has the angle of the clypeus developed to a definite black tooth. The red portions are entirely ferruginous, even the basal segment of the abdomen. Mittagong, New South Wales, 10th January, 1902, leg. W. W. Froggatt.

One female, larger than the type, with the red of the basal tergum reduced to two large lateral maculae. This form has been received from several other localities, and should perhaps be separated, but until the male is known it is referred to *rufobasalis*. Richmond, New South Wales, 2nd December, 1902, leg. W. W. Froggatt.

Sericophorus rufipes, sp. nov.

Type, female.—Length, 11 mm. approximately. Bluish-green, red legs.

Head dull-green, sericeous; face with the merest median rise; frons very smooth, with minute piliferous punctures; clypeus dark-green, dull, with much long white hair, and two large clypeal black teeth, many large coarse punctures; supraclypeal area not defined; vertex with a few white hairs; compound eyes converging a trifle above; genae with rather long white hair; labrum red; mandibulae ferruginous; antennae with suffused scapes and pedicel, flagellum clear-ferruginous.

Prothoracic collar not so appressed as in other species; tubercles blacker, with a fringe of white hair; mesothorax dull bluish-green, sericeous, scattered piliferous punctures; the black hair has white tips, anteriorly there are four sutures, two short and two long; scutellum green, conspicuously tuberculate, shining; postscutellum duller, with closer punctures; metathorax brighter, with considerable white hair, dorsum almost tessellate, closely punctured, numerous fine transverse striae below the dorsum; abdominal dorsal segments bluer, dull, closely and finely punctured, white hair almost in bands laterally, pygidial plate brown, with short coarse spines; ventral segments polished, with prismatic blue and green tints.

Legs ferruginous, coxae, trochanters, and femora basally bluish; tarsi ferruginous; claws ferruginous, pulvillus pale (black in most species); hind calcar reddish; tegulae brown; wings yellowish-hyaline; nervures ferruginous, recurrens far distant from the intecubiti; second cubital cell triangular, third cubital not contracted at top; pterostigma ferruginous; hamuli thirteen.

Locality.—Tasmania, "No. 2657, Lefroy."

Type in the collection of the South Australian Museum.

Allies: *S. sydneyi* Raym., which is smaller and bluer, with ferruginous tibiae, but the two insects are very close. *Sydneyi* has very dark neuration on the wings. The new species is easily known by its dull colour, white hair, and ferruginous neuration.

Maxwell Lefroy, the English entomologist, visited Tasmania, but the author is unable to discover whether or not he collected this insect.

Sericophorus rufotibialis, sp. nov.

Type, male.—Length, 8 mm. approximately. Dull-blue, red tibiae.

Head transverse, dull-sericeous; face with much white hair below, but less black hair above; frons hardly swollen; clypeus blackish, closely punctured, without teeth, not even the anterior angle developed; supraclypeal area not defined; vertex finely developed, with black hair; compound eyes converging a little above; genae microscopically tessellate, with white hair; labrum black; mandibulae reddish, darker on margin and apically; antennae short, black, thick, clavate.

Prothoracic collar not so appressed as in other species, a line of white hair; tubercles black, with a fringe of white hair; mesothorax dull, microscopically tessellate, numerous shallow piliferous punctures, a few black hairs; scutellum of similar sculpture, but darker, shining, and tuberculate; postscutellum blacker, shining, punctures more distinct; metathorax with dorsum defined by a fine ruga enclosing a rugoso-punctate reticulated area, seven or so coarse transverse rugae laterally; abdominal dorsal segments sericeous, with close piliferous puncturing and black and white hair; broad pygidial plate with short thick spines; ventral segments more polished.

Legs blue, except the red tibiae; tarsi all dark, except the red fifth, anterior comb of six red spines; claws red; hind calcar red; tegulae dull-piceous; wings subhyaline; nervures brown, recurrents equally distant from the intercubiti; cells normal for the genus; pterostigma blackish-brown; hamuli twelve.

Locality.—Blundells, 20 miles west of Canberra, A.C.T., 29th December, 1949, leg. E. F. Riek.

Type in the collection of the Entomological Division, C.S.I.R.O.

Allies: *S. chalybaeus* Sm., but easily separated by the absence of clypeal teeth, black flagellum and dark legs.

Sericophorus rugosus, sp. nov.

Type, female.—Length, 8 mm. approximately. Blue and green.

Head greener than thorax, with smooth microscopic tessellation; face with white hair on anterior portion; frons with a low mammiform swelling; clypeus black, two large nodes, outer one largest, angle almost developed to a node; supraclypeal area not defined, with closer punctures; vertex nude; compound eyes converging slightly above; genae with fine piliferous punctures and white hair; labrum brownish-red; mandibulae reddish, with much white hair basally; antennae missing from specimen.

Prothorax greenish, with some white hair; tubercles bluish; mesothorax sericeus, but smooth, bright, with inconspicuous piliferous punctures, and white hair near the scutellar suture; scutellum brighter, smooth, with a few punctures; postscutellum with close punctures; metathorax greener, with numerous rugae that is difficult to describe (see No. 11 in pl 5); pygidium hidden under a smooth black mass, but it has long coarse spines; abdominal dorsal segments greenish-blue, shining, with minute piliferous punctures, and a dusting of fine white hair; ventral segments more shining.

Legs bluish, but tibiae suffused with dark-reddish; tarsi red, suffused with reddish-brown; anterior comb with four long coarse spines; claws red; hind calcar dark-brown; tegulae dull-piceous, bluish basally; wings hyaline; nervures pale-sepia, the recurrents equally distant from the intercubiti; third cubital cell much contracted at top; pterostigma amber, with brown margin; hamuli eleven.

Locality.—Brisbane, Queensland, 10th October, 1916, leg. H. Hacker.

Type in the collection of the Queensland Museum.

Allies: *S. claviger* Kohl., which is smaller, with one tooth on the clypeus; *S. patongensis* by the rugose metathorax; legs of *S. claviger* much redder; *S. metallescens* is allied.

Sericophorus spryi, sp. nov.

Type, male.—Length, 9 mm. approximately. Blue, black head, red legs.

Head transverse, shining, closely punctured; face with a median tubercle; frons closely punctate, with scattered white hair; clypeus shining, closely punctate, anterior margin with one tooth; supraclypeal area produced to a large node; vertex compressed, with much black hair; compound eyes reniform; genae finely punctate, with a basal nodule, a few white hairs; labrum reddish; mandibulae ferruginous, blackish apically, typical of the genus; ferruginous antennae, scapes pedicel and apical segment black.

Prothoracic collar blackish-blue, pressed back flat against the scutum; a line of white hair, finely tessellate; tubercles blue, a fringe of white hair; mesothorax blue dull-sericeous, large punctures not contiguous, a few erect

black hairs; scutellum more shining, with a tubercle; postscutellum closely and finely punctate; metathorax blue, the cruciform constructure imposed on a fine oblique rugoso-punctate sculpture, the extreme lateral margins of which are deeply pitted; abdominal dorsal segments blue, shining, with a microscopic lineation, and close fine punctures, pygidial plate dark-brown; ventral segments more shining.

Legs ferruginous, coxae, trochanters and femora basally bluish; tarsi ferruginous, four basal segments darker; claws red, pulvillus black; hind calcariae red, one twice the length of the other; tegulae bright, piceous; wings hyaline; nervures amber, the recurrents about equally distant from the intercubiti, equalling the length of the apex of the second cubital cell; pterostigma large, palest-amber, margined with brown; hamuli eleven. (One specimen lacks the second intercubitus nervure, having only two cubital cells. See No. 2, text fig. 2.)

Locality.—Chelsea, Victoria, leg. late Frank Spry. Cavendish, Victoria, 8th January, 1948, leg. "B.G.?"

Type in the collection of the National Museum of Victoria.

Cotype in the collection of the author.

Allies: The abdomen is almost cordate. It is close to *S. claviger* and *S. violaceus* Raym., which is much larger, with two clypeal teeth.

Sericophorus subviridis sp. nov.

Type, female.—Length, 9.5 mm. approximately. Metallic-greenish, red legs.

Head transverse, dull-sericeous; face with scattered white hair, and a longitudinal carina produced to a median tubercle, and reaching the median ocellus; clypeus convex, with reddish patches, closely punctured, anterior margin with three low mammiform teeth, the two outer ones longest; vertex very short, a few white hairs; foveae reduced to obscure darker marks; compound eyes reniform; genae finely punctured, a few white hairs; labrum reddish; mandibulae entirely amber; antennae entirely bright-ferruginous.

Prothorax with a few white hairs; tubercles green; mesothorax sericeous, dull-green, inconspicuous piliferous punctures; scutellum shining black, scattered punctures, a large tubercle; postscutellum shining, hardly punctured; metathorax shining, bluer, with numerous transverse fine carinae below and laterad of the cruciform structure; abdominal dorsal segments somewhat slender, greener, a sprinkling of appressed white hair, basal produced into a median tubercle, pygidial plate dark brown, with a few short peg-like spines basally; ventral segments green, shining.

Legs entirely bright clear-ferruginous, only the coxae blue; tarsi ferruginous, seven long spines on anterior basitarsal comb; claws dark-red, pulvillus black; hind calcar bright-red; tegulae piceous; wings hyaline; nervures blackish-brown, first recurrent falls far distant from the first intercubitus; cells normal; pterostigma blackish.

Locality.—Victoria Valley, Victoria, 26th February, 1949, leg. "B.G.?"

Type in the collection of A. N. Burns.

Allies: Clearly close to *S. victoriensis*, which has two clypeal teeth, short spines on the pygidial plate, and light-ferruginous legs. Easily separated by the all white hair.

Sericophorus sydneyi, sp. nov.

Type, female.—Length, 9.5 mm. approximately. Greenish-blue, red legs.

Head dull-sericeous, inconspicuous piliferous punctures; face has considerable appressed white hair; frons divided by a fine black line, and a microscopic tubercle; green clypeus has three teeth on anterior margin; the third smallest; supraclypeal area not defined; vertex with considerable white hair; compound eyes reniform; genae with considerable white hair; labrum reddish; mandibulae amber, dark-red apically; antennae ferruginous, the scapes faintly suffused.

Prothorax has considerable white hair; tubercles bluish, with white fringe; mesothorax dull, bluer, with piliferous punctures, and some black hair; scutellum similar, but developed to a large compressed tubercle; postscutellum with closer punctation; metathorax with numerous fine transverse carinae that persist across the whole declivity of the epinotum; the dorsum shining green, with numerous punctures; the hair is all white except on the scutum; abdominal dorsal segments bluer, dull-sericeous with considerable white hair laterally, basal with a tubercle, black pygidial plate with very fine spines; ventral segments almost polished.

Legs ferruginous, only the coxae and trochanters green; tarsi and claws red; hind calcar ferruginous; tegulae dull-piceous, closely punctate; wings hyaline; nervures blackish, first recurrent far distant from the first intercubitus, third cubital cell hardly contracted at top; pterostigma brown, margined with black; hamuli thirteen.

Locality.—Bolgart, Western Australia, 16th April, 1950, leg. Rica Erickson.

Type in the collection of the National Museum of Victoria.

Allies: Plainly close to *S. chalybaeus* Sm., which has dark femora scapes and pedicel, and is larger, but the structure of the epinotum is very different, the species is dedicated to Sydney Erickson in appreciation of his assistance in collecting.

Sericophorus tallongensis, sp. nov.

Type, male.—Length, 8 mm. approximately. Metallic-green, black head.

Head black, transverse, close punctation of medium size; face with white hair on lower part, black hair on upper half; frons with a large swelling, and a small depression; clypeus with close punctures, larger on anterior half, with one tooth (as in *claviger*); supraclypeal area rising to a short carina; vertex rather finely produced; compound eyes reniform, anterior margins parallel; genae sericeous, piliferous punctures, white hair; labrum blackish; mandibulae black, obscure reddish tints; antennae black above, ferruginous beneath, the segments produced to a node, the apical one of a peculiar form.

Prothorax closely appressed to mesothorax; tubercles black, white hair; mesothorax sericeous-green, many punctures of medium size, erect black hair; scutellum similar, but tuberculate, shining, with larger punctures; postscutellum with closer smaller punctures; metathorax shining, finely rugoso-punctate, stem of cruciform incisure with sides parallel; four or so short rugae laterally, some black and white hair; abdominal dorsal segments sericeous-green, smoother than mesothorax, finer punctures, a few pale hairs, pygidial plate reddish, with fine spines; ventral segments similar.

Legs bluish, base of femora and all of tibiae dark-red; tarsi dull-reddish, suffused with brown; claws amber; hind calcar blackish; tegulae amber, black basally; wings hyaline; nervures sepia, normal for the genus, first recurrent farthest from first intercubitus; cells; third cubital much contracted at top; pterostigma sepia, darker margin; hamuli eleven.

Locality.—Tallong (altitude 2,000 feet), New South Wales, December, 1950, leg. Norman W. Rodd.

Type in the collection of the National Museum of Victoria.

Allies: *S. viridis* by the black head; *S. claviger* by the clypeal tooth, but *claviger* is very much smaller.

Taken with other males, which were diving down into the shafts.

Sericophorus teliferopodus, sp. nov.

Type, female.—Length 12 mm. approximately. Metallic bluish-green, red legs.

Head sculptured and coloured as in the male; face with white hair; clypeus with white hair more dense, and a red triangle, otherwise similar to male, anterior margin with three nodes laterally; supraclypeal area not defined; vertex with black hair, sharply developed; compound eyes with anterior margins parallel; genae inconspicuous, no malar area in either sex; labrum oval, reddish; mandibulae amber, darker apically; scapes short, blackish, flagellum reddish-ferruginous, with apical segments wider than long in both sexes.

Prothorax with white hair laterally; tubercles blackish; pleura blue, shining, a delicate tessellation; mesothorax with a sericeus sculpture; scutellum with a low median elevation and black hair, many punctures; postscutellum shining, with black hair; metathorax bluish, with a cruciform incisure as in the male; abdominal segments prismatic greenish-blue, closely punctured, shaped like a peg-top, that is, the second visible tergum is widest; apical segments and pygidial plate red, hind margins aeneas, a few white hairs laterally; ventral segments greenish, more highly polished; gradulus of sternum inconspicuous.

Legs bright-red, coxae, trochanters, and femora basally greenish-black; tibiae conspicuously spinose on outer surface; tarsi red, spinose, the fifth expanded; pulvillus excessively large, black, and formed like a complex web which, when open, resembles a large "paw"; claws small, reddish; hind calcariae red, finely serrated, one much longer than the other; tegulae piceous; wings entirely hyaline, with microscopic black hairs; nervures brown, first recurrent entering first cubital cell at about its apical fourth; second cubital cell small, greatly contracted at apex, receiving second recurrent at its apical fourth; pterostigma long, pale-amber, with darker margin; hamuli ten. The red pygidial plate of the abdomen with coarse amber spines.

Abdomen smaller than the strong thorax, and terga 3–4–5 (visible) have much appressed golden hair; several specimens have a brassy shade, with lilac reflections.

The Sandringham females are larger and more robust than one taken at Warburton, Victoria, leg. Chas. Oke.

Allotype, male.—Length, 7 mm. approximately. Metallic bluish-green.

Head transverse, blackish-green, with many punctures and a fine tessellate sculpture; face excavated around bases of scapes, some white hair laterally at base; frons with a large smooth tubercle and a median sulcus as in the female; clypeus black, shining, convex, closely punctured, anterior angle with a lateral nodule; supraalypeal area not defined, but rising to a median carina; vertex with black hair; compound eyes with anterior margins parallel; genae with fine punctures, a delicate sculpture, and a few white hairs; labrum a small oval; mandibulae dull-ferruginous; antennae with short black scapes, flagellum dull-ferruginous beneath, apical segment modified.

Prothorax lighter-green; tubercles blackish, with a fringe of white hair; mesothorax greener, a well-marked tessellate sculpture and many punctures giving a morocco-leather aspect; scutellum sub-tuberculate, a few black hairs, shining and blacker; postscutellum shining, with black hair; metathorax greenish-blue, shining, a wide sulcus formed like the letter "T", the groove divided by a number of transverse rugae; abdominal dorsal segments prismatic greenish-blue, apical segments red; the abdomen is of a peg-top form, with a red pygidial plate; ventral segments as in the female.

Legs red, slender, tibiae, armed with spiculae, darker parts as in female; tarsi amber, fifth large, with a conspicuous black pulvillus; claws small, as in female; hind calcariae red, one larger than the other; tegulae piceous; wings entirely hyaline; nervures as in female with the basal short, straight, and meeting nervulus; radial cell pointed on the costa; pterostigma long, pale, with a darker margin; hamuli ten.

Type locality, Sandringham, Victoria, 12th January, 1950, leg. Rayment. Cheltenham, Victoria, leg. F. E. Wilson.

Type, allotype, and cotype in the collection of the National Museum of Victoria.

It is not very close to *S. chalybaeus*, Sm., but nearer to *S. rufipes*, sp. nov.

Sericophorus teliferopodus okiellus, sub-sp. nov.

A female, slightly smaller than the species, but a trifle larger than the smaller form (see Table of Development). The insect is bluer, with much less hair, and lacks the coppery tints on the abdomen.

The two nodular teeth of the clypeus are minute (the angle is developed to a low nodule in the species); scapes clear ferruginous; the tubercle of the frons is highest on the black mark (it is highest below the mark in the species).

The scutellar tubercle is black and more prominent; dorsum of the epinotum has oblique rugoso-punctate sculpture laterad of the cruciform incisure, the stem of which is without transverse rugae (dorsum distinctly punctured and without rugae in the species); the large carinae below are irregular; pygidial plate truncate at extreme tip (rounded in the species), and the apical half has no spines.

Abdomen short and ovate, and almost nude; the femora with more red; nervures blacker, the second recurrent very close to the second intercubitus.

Locality: Melton, Victoria, 27th December, 1947, A. N. Burns.

Allies: Easily separated from *S. viridis* Sauss., which has a black head, by the ferruginous scapes.

The species is dedicated to Chas. G. Oke in appreciation of his assistance.

Sericophorus victoriensis, sp. nov.

Type, female.—Length, 10 mm. approximately. Dark greenish-blue, ferruginous legs.

Head dull-sericeous, with a sprinkling of white hair; frons with a short carina; clypeus blue, prominent, laterally with two teeth, outer one larger than the other; supra-clypeal area not defined; vertex with a few black and white hairs; compound eyes reniform; genae with a few white hairs; labrum black; mandibulae amber basally, dark-red apically; antennae entirely ferruginous, with a black dot apically.

Prothoracic collar not so closely appressed; tubercles bluish, with a fringe of white hair; mesothorax dull sericeous, as in *chalybaeus*, but pilose punctation not so close; scutellum with a conspicuous black ridge-like tubercle; postscutellum rougher; metathorax with many fine transverse carinae below the cruciform structure; abdominal dorsal segments greener, and more shining than those of *chalybaeus*, second morphological with a median tubercle as in *teliferopodus*, pygidial plate with short pegs basally; ventral segments more shining, simple.

Legs clear-ferruginous, only coxae and trochanters blackish; tarsi ferruginous; claws red; hind calcariae red, one much larger than the other; tegulae dull, piceous; wings faintly fuliginous; nervures brownish, recurrents about same distance from intercubiti; cells; third cubital hardly contracted at top; pterostigma brown; hamuli thirteen, strong.

Locality.—Portland, Victoria, February, 1913, leg. J. E. Dixon.

Type in the collection of the National Museum of Victoria.

Allies: *S. subviridis*, Raym., which has a bronze-green abdomen, and three teeth of red clypeus more widely spaced, and pygidial plate entirely covered with long coarse spines.

Sericophorus violaceus, sp. nov.

Type, female.—Length, 10 mm. approximately. Shining violet, with pale-ferruginous legs.

Head transverse, practically black in colour; face with rather long white hair; frons with a median elevation, and many punctures; clypeus prominent, the ferruginous colour reaching the base of the compound eyes, anterior margin with two small contiguous mammiform tubercles; vertex with white hair; compound eyes reniform; genae with white hair; labrum, mandibulae and antennae clear light-ferruginous, apical segment of flagellum black.

Prothorax blue, appressed, a few white hairs; tubercles black, with a fringe of ochreous hair; mesothorax with the sericeous lustre of the genus, but more shining than *chalybaeus*, a few black hairs, and numerous large punctures; scutellum almost black, subtuberculate, many large punctures; postscutellum bluer, with a closer punctation; metathorax with six short carinae below the cruciform structure, black hair laterally; abdominal dorsal segments shining, closely punctured, apical segments red, pygidial plate with stout spines of medium length; ventral segments similar, but more shining.

Legs clear pale-ferruginous, only the coxae blue; tarsi pale-ferruginous; claws ferruginous, pulvillus large and black; hind calcar ferruginous; tegulae amber; wings faintly amber; nervures golden-brown; cells typical of the genus; pterostigma amber, margined with brown; hamuli thirteen.

Allotype, male.—Length, 6.5 mm. approximately. Coloured like the female, but much smaller, and clypeus blue-black.

Head almost black; face with an obscure greenish lustre; frons with a small carina ending in a minute basin; clypeus blacker, closely punctured, with one small nodule on anterior margin; supra-clypeal area not defined; vertex with a few black hairs; compound eyes reniform; genae with white hair; labrum amber; mandibulae amber, darker basally and apically; antennae clear-ferruginous, apical segment modified, black.

Prothorax excessively reduced; tubercles blackish; mesothorax, scutellum and postscutellum as in female; metathorax with only four lateral carinae, but polished; abdominal dorsal segments very lustrous, and rich-coloured violet; apical segments clear pale-ferruginous; ventral segments more polished.

Legs clear, ferruginous as in female; tarsi, claws and hind calcar all ferruginous; tegulae brownish-amber; wings hyaline; nervures with outer recurrent and intercubitus weakened; the first recurrent falls far short of the first intercubitus; appendiculate cell weak in female; obsolete in male; hamuli eleven, weakly developed.

Locality.—Torrens Gorge, South Australia, January, 1940, leg. J. Womersley.

Type and allotype in the collection of the Adelaide Museum.

Allies: *S. chalybaeus* Sm., which is quite dull, with white hair on the metathorax. *S. violaceus* is the brightest and most beautiful species in the genus.

There is little doubt that this association of the sexes is correct.

Sericophorus viridis (Saussure).

Mem. Soc. Physique et Hist. Nat. Geneve, XIV., pt. 1, p. 25, 1855

(Since the original description is not available in Australia, the author gives the following translation from the French. The words in brackets are his.)

Female.—Length, nearly 10 mm.; of the wings 5.5 mm.

Head shining, blackish, and clothed with a rather long silky down (or pile) after the style of part of the posterior; mandibulae and palpi reddish; clypeus reddish; except the anterior margin, which is blackish, and terminated on each side by a small tooth directed down. Antennae of a ferruginous-orange; thorax very finely punctured; mesothorax bearing upon its anterior part two small furrows. Scutellum a little raised on middle. The furrow (cruciform structure) of the metathorax, coarsely punctured on the back, is continued so that it encloses the hind margin of the postscutellum. Plate at the back of the postscutellum (epinotum) transversely striate. Thorax of a metallic bluish-green, garnished (or clothed) with a downy pile of black hair; abdomen of a metallic green, bluer at the base, and passing (shading) to copper-colour towards the end; segments third and fourth of a coppery-green; the fifth brown, and the sixth red; the ventral surface black. All the abdomen covered with a ferruginous silky pile, the hair a little golden. Claws reddish; pulvilli (pelottes—a pad) and tarsi, coxae, trochanters, and base of femora blackish. Wings transparent, a trifle smoky; nervures brownish, pterostigma (écailles—a scale) brownish; second cubital cell triangular, the radial margin not so.

From New Holland.

The following additional characters will assist the student to separate this species. The lower part of the face has considerable appressed silvery hair, and actually there are two large teeth on the anterior margin of the clypeus, the outer one being quite long; the scutellum is green, with only the tubercle blackish; postscutellum greener, with scattered punctures, the lateral carinae of the epinotum are few, but coarse and conspicuous; pygidial plate is red, with close-set long spines; seven long evenly spaced strong spines on the anterior tarsal comb; pterostigma amber, with a darker margin.

New locality. Mt. Victoria, New South Wales, 5th January, 1931, leg. A. N. Burns.

These females differ from the type by the ferruginous coxae and trochanters, and some have a black spot on the apical segment of the flagellum.

Allies: Close to *S. teliferopodus*, which has three clypeal teeth, and lacks the coppery hair of the abdomen. The type is probably a male.

Sericophorus viridis roddi, subsp. nov.

A series of females from the South Coast of New South Wales are slightly smaller, with the clypeus more or less suffused with bluish laterally, and there are three nodular teeth on the anterior margin; antennae with the apical segment largely black. Pygidial plate darker.

The legs are of a darker red, the coxae, trochanters and base of femora dark, and there are seven long strong spines on the anterior tarsal comb. The abdomen shows lilac tints in certain lights.

The first recurrent is far distant from the intercubitus.

The spines of the pygidial plate are fewer, shorter and coarser, than in the species, and the sculpture of the dorsum is coarser, and there are fewer, but coarser transverse striae below.

These females will probably be raised to full specific rank when more is known about them.

Locality.—Fraser Park, New South Wales, 27th December, 1947, leg. Norman W. Rodd.

Paratypes in the collections of Rodd and Rayment.

One female, with yellowish wings, and the incision on the inner margin of the spoonlike mandibles subobsolete. Spines on pygidium short and stout. First recurrent farther from the first intercubitus nervure; may have to be separated when the male is known. Id. by Froggatt as *S. viridis*. Shoalhaven, New South Wales, 1895, leg. probably W. W. Froggatt.

A DERIVATIVE GENUS

A group of black wasps differ from *Sericophorus* by the absence of the cruciform incisure on the dorsum of the epinotum. These distinctive species are easily separated, and the author proposes a new genus, *Anacrucis*, to include them.

The incisure is probably a development of the pitted sutures of the thorax, for similar short transverse rugae are present in the scutellar sutures of the *S. relucens* complex. (Fig. 10, pl. 5.) The fine longitudinal line on the dorsum of *Anacrucis* is undoubtedly a vestigial remnant of the structure.

Hymenopterists have shown in *Colletes* and *Halictus*, APOIDEA, that rugose sculpture is more primitive than smooth integument, and on the phylogeny, *Anacrucis* could be derived from *Sericophorus*.

Morphologists will agree that it is easier to lose a character than to acquire a new one, and in *Sericophorus rugosus* and *S. metallescens*, the incisure is definitely weakened. (Figs. 7 and 11, pl. 5.) The absence of the character could be explained by a genetical defect, loss of the genes responsible for the structure.

Anacrucis, genus nov.

(*An*—not, and *crucis*—a cross)

Sericophorine wasps of medium size, with large heads, and short submoniliform antennae; mandibles spoon-like, the incision of the inner margin adapted to the clypeal teeth or nodules as in *Sericophorus*. The mouth-parts

could not be removed for comparative studies. Labrum larger; facial foveae clearly defined as depressed areas; frons with a mammiform swelling. Females may have only one clypeal tooth.

The prothoracic collar is not so appressed, and is thickened laterally; the scutal and parapsidal furrows of the mesothorax inconspicuous; propodium large, smooth, without coarse rugae, the cruciform incisure obsolete.

The general aspect of the abdomen is brighter, and the terga smoother, but the pygidial plate is coarsely spined. The legs are strong, but the spiculae of all are very much weaker; the fifth tarsus and pulvillus smaller; anterior tarsal comb strongly spinose; posterior calcariae much shorter.

The wings are dark, and the basal nervure somewhat arched; the second recurrent nervure far distant from the second intercubitus; third cubital cell narrower; hamuli more numerous.

Males not known.

Type locality. Frankston, Victoria, probably collected by the late F. Spry.

Anacrucis laevigata gen. et sp. nov.

Genotype, female.—Length, 11 mm. approximately. Black, red legs.

Head transverse, covered with appressed golden hair; frons with the mammiform swelling divided by the frontal line so that it becomes bituberculate; clypeus sericeous, closely punctured, with three subequal teeth on anterior margin, inner one longest; supra-clypeal area not defined, but "face" excavated anteriorly; vertex with ocelli on prominences in a triangle; compound eyes converge only slightly above; genae sericeous, with appressed white hair; labrum more convex, dark-red; mandibulae more spoon-like, dull ferruginous, otherwise like *Sericophorus*; antennae with short black scapes, flagellum black above, ferruginous beneath, submoniliform.

Prothorax not so appressed as in *Sericophorus*, with white hair; tubercles black, with a fringe of white hair; mesothorax dull-sericeous, closely punctured, practically nude; scutellum and postscutellum similar; metathorax with dorsum almost polished, a fine longitudinal line, and a few short rugae extending from the postscutellar suture, otherwise finely punctured, with some white hair laterally; abdominal dorsal segments with a smooth satin-like lustre, and microscopic piliferous punctures, apically with wide amber margins, pygidial plate yellowish, with many fine pale spines; ventral segments polished-black.

Legs red, fifth tarsi and pulvillus not so large as in *Sericophorus*; tarsi red, anterior comb with seven long spines; claws red; hind calcar reddish-amber; tegulae dull-amber; wings fuliginous; nervures brown, second recurrent entering middle of small triangular second cubital cell; third cubital cell very narrow; pterostigma black, large; hamuli fifteen.

Locality.—Frankston, Victoria, probably collected by the late F. Spry.

Genotype in the collection of the National Museum, Melbourne.

Allies: Not close to any other species.

Anacrucis striatula, sp. nov.

Type, female.—Length, 8 mm. approximately. Black, red legs.

Head sericeous, with appressed metallic golden hair; face excavated below the frontal rise; frons with a minute longitudinal swelling; clypeus minutely and closely punctured, with long golden hair; anterior margin with two small nodular teeth; supra-clypeal area not defined; vertex nude; compound eyes converge only slightly above; genae with a few white hairs, dull-sericeous; labrum black; mandibulae practically black; antennae short, black, submoniliform.

Prothorax produced to an angle directed apicad, not so appressed, bracket-shaped, with white hair; tubercles black, with white hair; mesothorax sericeus, dull, close piliferous punctures, appressed black hair; scutellum large, brighter, otherwise like mesothorax; postscutellum similar; metathorax with dorsum posteriorly polished, laterally with close longitudinal striae and fine punctures; abdominal dorsal segments very smooth, many fine piliferous punctures, apical four with long golden hair; pygidial plate with long pale spines; ventral segments polished.

Legs dull-red; tarsi lightly suffused with blackish; claws red; hind calcar red; tegulae reddish-amber; wings brownish; nervures reddish-brown; second recurrent entering second cubital cell beyond the middle; third cubital cells very narrow; pterostigma blackish; hamuli thirteen.

Locality.—Jamberoo, New South Wales, 9th January, 1950, Norman W. Rodd.

Type in the collection of Norman W. Rodd. Paratype in the collection of the author. Mt. Kiera, New South Wales, 13th March, 1949, C. E. Chadwick.

Allies: Not close to any described species.

Anacrucis asperithorax, sp. nov.

Type, female.—Length, 10 mm. approximately. Black, red legs.

Head transverse, dull sericeus; face practically naked; frons with a low prominence tending to become bituberculate; clypeus of sculpture similar to frons, anterior margin with one inconspicuous low black tooth; supraclypeal area rising to a shining line that reaches the median ocellus; vertex with numerous punctures as on the rest of the head, and foveae well-marked; compound eyes with anterior margins almost parallel; genae tessellate, with a few white hairs; labrum black; anterior margin of clypeus polished; mandibulae shining black, an obscure reddish median mark; antennae black (portion of flagella missing in type).

Prothorax with a yellowish bar laterally; pleura dull-sericeus; tubercles dull-black, a fringe of ochreous hair; mesothorax dull, sericeus, practically nude, numerous shallow punctures; scutellum and postscutellum similar; the dull thorax in sharp contrast to the smooth shining abdomen; metathorax shining, with a kind of rough punctured tessellation, a longitudinal line, and vestiges of rugae basally where the cruciform structure should be; abdominal dorsal segments smooth, shining, microscopically lineate, very little hair, and a few minute piliferous punctures; caudal plate blackish, with short thick spines; margins of terga depressed; ventral segments polished.

Legs red, coxae black, anterior tarsal comb of four spines; tarsi of a slightly darker red; claws red; hind calcar reddish; tegulae reddish-amber; wings subhyaline; nervures brownish, the recurrences equally distant from the intercubiti; cells normal for the genus; pterostigma dark-brown; hamuli fourteen.

Locality.—Bolgart, Western Australia, 3rd September, 1947, leg. Rica Erickson. Female, from "nest" in ground, 4th November, 1951, leg. Rica Erickson.

Type in the collection of the author.

Allies: Approaches closely the larger more robust *A. laevigata* by the absence of striae on the dorsum. The Victorian insect has three conspicuous teeth on the clypeal margin, and a red pygidial plate.

Anacrucis cingulata, sp. nov.

Type, female.—Length, 11 mm. approximately. Black and ferruginous.

Head almost circular from the front, dull-black; face with the anterior half covered with dense appressed metallic straw-coloured hair; frons coriaceous,

with a swelling above the insertion of the scapes; clypeus ivory-coloured, anterior margin with two small black nodular teeth; supraclypeal area not defined; vertex short, dull; compound eyes converging above; genae with silvery-white fine hair; labrum reddish-amber; mandibulae yellowish-amber, reddish-black apically; antennae missing on type.

Prothorax black, a few silvery hairs; tubercles long, black, with a fringe of white hair; mesothorax black, dull, coriaceous, with dense small shallow piliferous punctures, and minute black hair; scutellum large, otherwise similar; postscutellum similar, but with white hair; epinotum dull, coriaceous, with minute piliferous punctures, posteriorly considerable appressed silvery hair; dorsum with a strong median sulcus divided by a fine carina, the transverse arm of the incisure, in the scutellar suture, with a few delicate longitudinal striae extending over the dorsum; abdominal terga black, dull, with microscopic piliferous punctures, the hind margins broadly depressed and ferruginous, apical segment red, pygidial plate light-reddish, with numerous short strong spines; sterna polished black, with narrow ferruginous margins; each tergum with several long amber setae (usual for the Sericophorine wasps).

Legs black, tibiae and hind and median femora distally ferruginous, anterior femur ferruginous with some ivory-colour; tarsi ferruginous, anterior comb with seven spines; claws simple, amber, with dark-red tips; pulvillus of moderate development; calcariae long, amber; tegulae dull-amber; wings yellowish; nervures sepia, first recurrent far distant, from the intercubitus; third cubital cell but little contracted at top; pterostigma reddish-amber; hamuli twelve or so.

Locality.—New South Wales (Milthorpe, March 1942?), leg. N. C. Lloyd.

Type in the collection of the Agricultural Department, New South Wales.

Allies: Not close to any described species, and easily separated by the ferruginous bands of the abdomen.

Anacrucis clypeata, sp. nov.

Type, female. Length, 8 mm. approximately. Black with red legs.

Head transverse, with considerable appressed silvery hair; face closely punctured, but shining; frons with a low mamiform swelling, and a longitudinal fine line; clypeus palest-amber, with the anterior margin reflexed vertically by a deep emargination developed to a long tooth laterally, beyond which are two smaller nodules; vertex closely punctured, foveae conspicuous; compound eyes converge above; genae closely punctured, with much appressed white hair; labrum black; the glossae appears to be much longer in *Anacrucis*; mandibulae very long, amber, blackish basally and apically; antennae black, sub-filiform, apical segment compressed.

Prothorax black, with an interrupted pale-yellow line; tubercles black, with a tellow spot; mesothorax shining, numerous punctures on a smooth ground, a few whitish hairs; pleura transversely striate; scutellum finely punctured; postscutellum more closely punctured; metathorax with numerous oblique striae and punctures, and a longitudinal median line with a few short transverse striae; abdominal dorsal segments closely and finely punctate, posterior margins broadly depressed, a dusting of appressed white hair; ventral segments more shining; pygidial plate with long pallid spines.

Legs bright-red, only the coxae black; tarsi red, anterior comb of five slender spines; claws red; hind calcar red; tegulae yellowish-amber; wings subhyaline; nervures dark-brown, the recurrents equally distant from the intercubiti; cells normal; pterostigma dark-brown; hamuli twelve.

Locality.—South Yarra, January, 1950, leg. Lynette Young.

Type in the collection of the author.

Allies: Not close to any described species, but approaches *A. striatula* Raym. by the striae of the dorsum, but striae are longitudinal in this species *A. clypeata* is unique by the remarkable structure of the clypeus.

Anacrucis ferruginea, sp. nov.

Type, female.—Length, 10 mm. approximately. Black, ferruginous abdomen.

Head black, coriaceous, dull, transverse; face on anterior half with a dense covering of appressed silvery hair; frons closely punctured, with a leathery aspect; clypeus ivory-coloured, anterior margin with two minute teeth; supraclypeal area black, with a minute sulcus above; vertex coriaceous, narrowly produced; compound eyes converging above; genae microscopically punctured with white hair; labrum reddish; mandibulae amber, reddish-black apically; antennae entirely clear ferruginous, submoliform, apical segment compressed.

Prothoracic collar not appressed, black, rather large for the genus; tubercles black, with a fringe of white hair; mesothorax coriaceous, with close minute punctures, and a narrow rim or epaulette over the tegulae; scutellum and post-scutellum similar; pleura shining, with minute pilferous punctures; dorsum of metathorax with a strong longitudinal sulcus divided by a fine carina, and a fine longitudinally striato-punctate sculpture, some white hair posteriorly; abdomen ferruginous, slightly suffused on terga three and four; pygidial plate ferruginous, with pale-amber long stout spines; ventral surface polished.

Legs blackish, tibiae and knees ferruginous; tarsi ferruginous, claws amber; hind calcar pale-amber; tegulae dull-amber; wings yellowish; nervures sepia, first recurrent far distant from intercubitus; the small second cubital cell forming an equilateral triangle; pterostigma amber; hamuli thirteen.

Locality.—Wauchope, New South Wales, 1919, leg. W. Goodacre.

Type in the collection of Agricultural Department, New South Wales.

Allies: Not close to any described species, and easily known by its large size and ferruginous abdomen and legs.

Anacrucis punctuosa, sp. nov.

Type, female.—Length, 7.5 mm. approximately. Black, red legs.

Head transverse, so excessively closely punctured as to appear granular; face with much white hair on lower part, contrasting with golden hair on upper half; frons with a short line below; clypeus masked with white hair, anterior margin with two small nodular teeth; supraclypeal area not defined; vertex with ochreous hair; compound eyes only slightly converging above; genae coriaceous, with white hair; labrum dark-red; mandibulae amber, with dark margins; antennae short and black, segments broader than long.

Prothoracic collar with an interrupted yellow line; tubercles black, with amber margin; mesothorax densely and finely punctured, practically nude; scutellum similar; postscutellum with closer smaller punctures; metathorax with the dorsum defined by a fine ruga, outside of which is coarsely rugose, within it is finely punctured, with much white hair, and a fine longitudinal line; abdominal dorsal segments shining, closely punctured, with a dusting of white hair; pygidial plate brown with short spines; ventral segments polished, with amber margins.

Legs red, but coxae, trochanters and femora basally black; tarsi darker, anterior comb with seven long strong spines; claws amber; tegulae piceous, with a yellow spot; wings subhyaline; nervures sepia, the recurrents equally distant from the intercubiti; cells normal; pterostigma sepia; hamuli thirteen.

Locality.—Nedlands, Western Australia, 1st December, 1946, leg. K. R. Norris.

Type in the collection of the Entomological Division, C.S.I.R.O., Canberra, A.C.T.

Allies: Not close to any other described species, but easily known by the absence of rugae in the enclosed area of the dorsum.

It is pinned with its prey, a grey fly *Lispa cana* Walk.

The following KEY will assist students to separate the several black species in the genera *Anacrucis* and *Astaurus*.

Clypeus pale-amber	..	..	..	..	..	..	1
Yellow lateral face-marks	..	..	..	..	..	..	7
Abdomen ferruginous	..	..	..	..	..	..	8
1. Thorax shining, <i>A. clypeata</i> Raym.							
Clypeus black	..	..	..	..	..	..	2
2. Thorax dull-sericeous, <i>A. asperithorax</i> Raym.							
Dorsum with longitudinal striae	..	..	..	..	..	..	3
3. Face with much golden hair, <i>A. striatula</i> Raym.							
Dorsum without striae	..	..	..	..	..	..	4
4. Larger, more robust insect, <i>A. laevigata</i> Raym.							
Dorsum with oblique striae	..	..	..	..	..	..	5
5. Face with much silvery hair, <i>A. clypeata</i> Raym.							
Dorsum with enclosed punctate area	..	..	..	..	..	..	6
6. Prothoracic collar with a yellow line, <i>A. punctuosa</i> Raym.							
Dorsum with enclosed polished area	..	..	..	..	..	..	7
7. Clypeus yellow, <i>Astaurus hylacoïdes</i> Raym.							
Prothoracic collar entirely black, abdomen red, not banded	..	..	..	..	..	..	8
8. Dorsum with enclosed striato-punctate area, <i>A. ferruginea</i> Raym.							
Abdomen black, with ferruginous bands	..	..	..	..	..	..	9
9. Dorsum without an enclosed area, <i>A. cingulata</i> Raym.							
Abdomen with yellow maculae	..	..	..	..	..	..	10
10. Scutellum black, <i>Astaurus hylacoïdes</i> Raym.							
Abdomen without Maculae	..	..	..	..	..	..	11
11. Scutellum yellow, <i>A. tenuicornis</i> Raym.							

THE LINK WITH THE BEES

Astaurus genus nov.

The actual bridge linking the wasps and the bees appears to be a remarkable insect taken near Portland, Victoria. It bears an astonishing resemblance to certain hylaeid males, such as *Hylaeus chrysoognathus* Ckll., and approaches the genus *Phenacolletes*, which Cockerell separated from *Tachytes* only with difficulty. However, Cockerell's bee has the first recurrent nervure entering the second cubital cell. The author deems it advisable to propose a new generic name, and submits the following diagnosis.

Small polished black wasps, marked with yellow on the "face", scapes, a line on the prothoracic collar, a spot on the tubercles, and a large mark posteriorly, a fine line on the postscutellum, a macula laterally on the second abdominal tergum, and reddish-yellow tibiae and tarsi. The hair is silvery, sparse and straight, with microscopic irregularities which appear to be the elements of plumosity.

The head and genae are large, of the quadrate type of *Megachile*; no teeth on clypeus, which is not like that of the wasps, but long and bee-like; scapes inserted high on the "face"; the long filiform antennae has thirteen segments as in male bees. It is difficult to examine the mouth-parts, but there appears to be six segments in the maxillary palpus, and four in the labial palpus. The mandibles appear to be bidentate.

The collar is not appressed, and the dorsum of the epinotum is much reduced and polished, almost without sculpture, although there is an enclosed area running down posteriorly over the declivity; in the area are three or so inconspicuous striae which are undoubtedly vestiges of the cruciform structure as seen in *Anacrucis*.

There is a smooth pygidial plate, with fine pale spines, which are more or less confused with the caudal hair.

The legs are slender, and the tibiae have small weak inconspicuous spines; the pulvillus is not larger than that of bees. The fourth tarsal segment is minute, but the fifth is very long, and the large claws are simple; the strigilis of the anterior leg is short and stout, and one of the hind calcaria is likewise broad, there is a difference in the length of the pair.

The pterostigma is large, and the first recurrent nervure is received by the first cubital cell, as in all SERICOPHORINAE, but the small second cubital cell is not triangular, and with the third cubital cell, more nearly quadrate as in certain colletid bees.

The genitalia approach the form of the HYLAEIDAE, and are devoid of any vestiture; they are perhaps closest in shape to *Euryglossimorpha*.

Allies: It is evident that the coloured "face", and the loss of the cruciform structure, could have come down through *Anacrucis* with filiform antennae; the long clypeus shows a near approach to that of typical bees, but the neuration of the wings shows affinity with *Sericophorus*. The insect is the most bee-like wasp yet described, and it is unfortunate that no female is available for study. The biology should be of singular interest.

The author is indebted to his friend, the Revd. Doctor D. M. Morris, The Monastery, Croydon, Victoria, for suggesting the name *Astaurus*, from the Greek—without a cross.

Astaurus hylaeoides gen. et. sp. nov.

Genotype, male.—Length, 7 mm. approximately. Black and yellow.

Head large, polished between the many punctures of medium size; face-marks limited to a small lunate yellow patch laterally; frons divided by a deep sulcus that reaches and encloses the median ocellus; clypeus yellow, many shallow punctures and much white hair; supraclypeal area well defined, with a yellow triangular mark; vertex with large smooth areas lateral of the ocelli; compound eyes large, bulging, diverging from the upper half; genae large, many fine punctures, a few white hairs; labrum black; mandibulae black; antennae filiform, thirteen segments, scapes yellow, stout, a black mark basally; flagellum black.

Prothorax black, not appressed, a fine yellow line dorsally; tubercles black, with a yellow dot, a large yellow mark posteriorly; mesothorax black, polished, scattered piliferous punctures, a few black but more white hairs; scutellum similar; postscutellum black, with a narrow yellow band; metathorax black, polished, laterally with scattered coarse punctures, and some white hair, a polished enclosed area shaped like a Moorish arch, with faint indications of

striae; abdominal dorsal segments black, scattered large punctures, a few white hairs; the second with a large yellow macula laterally; a short rounded pygidial plate with fine pale spines, ventral segments black, polished.

Legs black, femora apically reddish, tibiae reddish, anterior with a yellow stripe, all tibiae armed with weak spiculae; tarsi slender, yellowish, fourth very small, fifth very long, pulvillus small; claws simple, large amber basally, red apically; hind calcariae red, subequal, one broad, approaching the form of the strigilis; tegulae amber, polished; wings hyaline; nervures blackish, the first recurrent entering the large first cubital cell; the second recurrent practically meeting the second intercubitus; second and third cubital cells only slightly contracted at top; pterostigma large, blackish; hamuli nine.

Locality.—Gorae West, Victoria, 31st December, 1950, leg. A. Clifford Beaglehole.

Genotype in the collection of the author.

Allies: *Hylaeus* by the form and colour of the body; *Anacrucis* by the filiform antennae and absence of the cruciform structure; and *Sericophorus* by the neururation of the wings and the spiculose tibiae. It approaches *Phenacolletes* Ckll., where the second cell receives the first recurrent nervure.

This male is close to *A. tenuicornis* Raym. which has a yellow scutellum, black abdomen and yellow tubercles.

Taken on flowers of *Leptospermum scoparium* at 1 p.m., together with *Sericophorus chalybaeus* Sm.

Astaurus tenuicornis, sp. nov.

Type, male.—Length, 7 mm. approximately. Black and primrose-yellow.

Head black, almost circular from the front, shining; face-marks butter-yellow, laterally, subtriangular; frons smooth, a median fine sulcus, minute piliferous punctures; clypeus yellow, many piliferous punctures with white hair; supraclypeal area yellow, pyramidal; vertex of medium length, ocelli set in shallow depressions; compound eyes large, diverging on upper half; genae prominent, sculptured like the frons, a few white hairs; labrum small, oval, black; mandibulae black, bidentate, but acute; antennae black, scapes yellow in front, flagellum filiform, somewhat suffused with ferruginous.

Prothorax black, a yellow line dorsally; tubercles yellow, posteriorly a swollen yellow circular mark; mesothorax black, smooth, bright, many small piliferous punctures; scutellum and postscutellum smooth and butter-yellow; metathorax black, with a polished enclosed area, laterally some silvery hair; abdominal dorsal segments black, smooth, piliferous punctures much larger than those of thorax; ventral segments similar.

Legs black, anterior tibiae reddish in front, also the tarsi; without spiculae; tarsi black, except anterior, a few white hairs, pulvillus small; claws black, long, simple; hind calcariae subequal, black, finely serrated; tegulae black, fine punctures; wings hyaline; nervures blackish-brown, first recurrent entering first cubital cell; radial cell pointed on costa, second cubital contracted at top, third not so; pterostigma large, blackish; hamuli seven, weak.

Locality.—Lane Cove, New South Wales, 16th January, 1947, leg. Norman W. Rodd. Cheltenham, New South Wales, 13th January, 1951, leg. Norman W. Rodd.

Allies: *A. hylaeoides* Raym, which has a yellow spot on tubercles, black scutellum, two large yellow maculae on the abdomen. The two males are close, but distinct, and easily separated.

On flowers of *Angophora cordifolia*.

BIOLOGY OF SERICOPHORUS

In the summer of 1949 the author discovered a type of insect architecture which he had at first confused with the earthworks of a bee, *Paracolletes tuberculatus* Ckll., the tumuli of which were known to be near the site. Closer investigation, however, soon revealed unmistakable differences, the aperture of the shaft was too large for the bee, and there was a ring of hard sand about the pit-mouth.

About the 1st of January, 1950, numbers of large moundlets of bright-golden sand were thrown up conspicuously on the "nature strip" bordering a road over an old sand-dune at Sandringham, Victoria. Each tumulus was composed of about 60 c. cu. of clean moist sand, and in the centre was an opening 6 mm. approximately in diameter.

The shafts were separated by about a metre, and more than 50 moundlets were counted on the 20th January. Light rain at night sometimes cemented a circle of sand over the shaft, but later in the morning these fragile rings were thrust unbroken to one side, as though unwanted by the excavator. Heavy rain washes the moundlet entirely away.

Although the colony was kept under daily observation until 1st May, four months later, the excavators were seldom observed, for most of the digging was done as early as dawn; usually the tumuli were of quite fresh damp sand, which dried quickly.

The investigations at Sandringham over 1949-1952 were confirmed by two of the author's collaborators, Rica Erickson, at Bolgart, Western Australia, and Norman Rodd, Sydney. Their observations are printed in a narrower measure.

"On the early morning of 11th May, after a deluge of rain, and while the ground was still very wet, I discovered two heaps of soil, about a yard apart, and just outside a door where I could keep them under almost continuous observation."

"I distinguished them as "A" and "B." The mounds were not present on the evening before, and must have been thrown up during the night or about dawn. Some twenty other nests were found within the next few days."

"I must remark on the peculiar arrangement of the nests. They are generally paired; eight were less than a foot apart; another eight were paired about a yard distant; two as far apart as 5 feet, and four shafts were singles 10 feet away. Do the two wasps from one shaft build nearby?"—R.E.

At Sandringham, Victoria, on the 12th February, 1950, one of the greenish iridescent wasps with reddish legs and antennae, *S. tcliferopodus*, Raym. was observed to begin her excavation. The femur of the anterior legs is the largest, and its robust development is correlated to the fossorial habits of the wasps, for most of the digging is done by the front legs; the tarsal rakes rapidly flinging the sand backwards under the abdomen. Later, the expanded fifth segment of the tarsi and the large pulvillus come into action as a broad scoop to lift out the sand.

These observations were repeated over many days at 5 a.m., even when the temperatures registered 10° C. Wasps were netted at intervals to make certain of identification. On one day a smaller wasp was observed to fly close behind another, and the two were taken. They proved to be a male and a female of the new species. The wasps have the superficial appearance of the fossorial bee *Paracolletes pictus* Raym., which has a similar bright-fulvous tip on the abdomen. Other wasps are most active on bright hot days, but *Sericophorus* prefers the cool hours of early morning.

“The wasps emerged from the shafts at about 10 a.m., and were absent for long periods, perhaps feeding, and the only blossoms available were those of “Wandoo, *Eucalyptus redunca*, and a red *Epacris*, but I have never seen the wasps on the latter species.”—R.E.

The species collected by Rica Erickson, in Western Australia, proved to be new, *S. sydneyi* Raym.

The smaller black species, *S. pascotti* Raym., was frequently observed at Sandringham, Victoria, on very hot days in February, searching for suitable home sites in compacted sand, but she appears to be rather captious, for after a frenzied raking of the sand for a minute or two, she dashes off to try elsewhere. She hunts for small flies, but the actual species sought for prey has not been determined. These traits have been observed in *S. relucens* Sm. and the two subspecies.

The fact that the wasps work early and unobtrusively undoubtedly accounts for their comparative rarity in collections, but it is remarkable that such large colonies should have eluded observation for so many years. The summers of 1950–1951 will be remembered for record precipitation, with a humid atmosphere, and repeated flooding of wide areas in Eastern Australia; perhaps such conditions favour the distribution of the species.

“ I think the season must be just beginning for the wasps, that is, after the rains, for now heaps of soil are beginning to show in many places in the garden. Apparently the dampness of the garden made it an oasis for the insects. I had not noticed them in other years.”—R.E.

ARCHITECTURE

Much of the wasp's life is spent underground, excavating a shaft and two cells in sand, but just how many shafts are constructed by one female could not be ascertained, although the digging is easy, and very probably six or more are excavated. The wasp appears to take little time to capture sufficient prey for one cell.

The bright-golden sand, stained by oxide of iron, stands out in sharp contrast to the dark humus of the top-soil, but heavy rain often washes it entirely away, so that the position of the shafts cannot then be identified. The site of the colony is on the summit of a small hill, and no water could lie about, and it was observed that many of the wasps dug shafts between the pitchers of the street channels; no doubt attracted by the warmth of the dark basaltic cubes when heated by the sun. It was noticed that as autumn approached the stones were neglected. In May, the temperature of the sand near the cells registered 12° C. Work had then ceased for the season.

The entrances to the shafts are usually masked by much loose sand, but the female has no difficulty in returning with certainty to her own home, and burrows quickly down out of sight. The remarkable pulvillus, or large webbed structure between the two short claws, together with the expanded fifth tarsal segment, act as a capacious “ paw ”, with which the sand is scooped up with the utmost efficiency. At the base of the shaft there is a χ -shaped branch, with a cell at the end of each gallery, which is about 7 cm. in length. The main shaft, which is not quite vertical, goes down for about 37 cm. When the shaft is open the wasp is away hunting; when closed, she is at home resting.

“ I saw a wasp ‘ scouting ’ over the ground as though searching for a suitable site. The shaft appears to go straight down, but I watched one wasp that preferred to enter her shaft under a fallen gumleaf, where the pellets of soil had to be compressed to form a horizontal tunnel. This method entailed a lot of extra labour in cramped conditions.”

" I dug out one shaft, which had a diameter of $\frac{1}{8}$ inch, and descended perpendicularly for 5 inches; it then deviated round some pebbles, and then went down again for 3 inches. I found the first cavity to the west of the shaft at 9 inches down, and the second, on the east, at $8\frac{1}{2}$ inches. Both chambers were pear-shaped, and so far as I could see, without any lining."—R.E.

Completed shafts were again investigated at Sandringham, on 22nd April, 1950-51-52, and careful examination showed a few threads of silk woven over the cell-wall, forming a loose net to enclose the bodies of the prey in a compact mass. Several full-grown larvae were taken out of the cells, and one had a black mass resting on the ventral surface within reach of the mandibles, which made feeble efforts to eat a little more of the substance. The many black setae scattered over the larva appeared to have come from the bodies of flies.

In the base of the cocoon there is cemented a thin black disc, and this appears to be the excremental debris ejected by the larva soon after the mesenteron is joined to the proctodeum. The colour is no doubt due to the melanin in the integument of the flies. The inner surface is dusted with white granules, probably urates, calcium carbonate, phosphates, &c.

LARVAL FOOD

Some of the abandoned cells held the disjecta membra of blow-flies, and several chambers contained twelve heads, twelve thoraces, 48 wings and numerous legs. The flies were larger than those collected by Rica Erickson, and are certainly the common golden-haired blow-fly, *Neopollenia stygia* Fabr. The wasp from Western Australia is smaller (7 mm. in length) than the Sandringham species (10 mm. in length), consequently the prey is smaller; the fly is *Musca vetustissima* Walk². (The prey sought in the other States is given on p. 79).

The western fly is 5 mm. in length, black and hairy, with many strong bristles. It is a very numerous species, and pesters people by alighting in numbers on the back, and thus is frequently carried into the house. Both the eastern and the western flies are well-known pest species.

Like the western species *S. sydneyi*, the Sandringham wasp, *S. teliferopodus*, does most of the excavating just before dawn, so that the observer must be in the field before 6 a.m. The hunting is, however, done much earlier, and the period of greatest activity

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1. Syn. *Anastellorhina stygia* (Fabr.)
 2. Syn. *Musca pumila* Maqr.

is between 5 a.m. and 6 a.m., and on the 3rd of December, 1950, females were returning with a fly every three minutes. They remained below for about two minutes. They then re-emerged without rest to resume their hunting.

There is no hesitation in the female's return to the shaft; she just dives headlong down with her prey, hence the necessity for a large entrance. The author has taken a number of laden females to examine the prey, and in every case the fly appeared to be quite dead.

All the flies examined have been males, and the author concludes that female blow-flies are not taken by the wasps. The predator's preference for male victims is not difficult to understand. The death of the mother fly does not necessarily involve the death of her progeny, and should a mother be injured, the lively young maggots are extruded in numbers¹. Therefore, should a gravid female fly be taken below to the cells, the young maggots would certainly destroy the wasp's larva before it could destroy them.

The author and his assistants have on many occasions captured male blow-flies entering in and departing from the shafts of the wasps, and this fact poses the question of whether or not the dangerous attraction for the male flies lies in a chemotropism—the scent of the wasps may be an irresistible lure. On the other hand, it may be merely a case of "like attracts like"—the odour of the flies stored in the base of the shaft.

LARVAL DEVELOPMENT

The elongate cylindrical egg measures 3 mm. at the long axis and 1.3 mm. at the short, so that it is proportionately much longer than the eggs of bees. Like most of the eggs of the *Hymenoptera*, it is glued into place by a secretion from glands at the apex of the female abdomen.

The egg is attached to the ventral surface of the thorax, close to the coxa of the anterior left leg, and on hatching, the larva attacks the thin chitin at the articulation for its first mouthful, perhaps by sucking, but later, when its mandibulae are more strongly chitinized; the harder legs and body are eaten.

Any vigorous movement of the fly's legs would certainly dislodge the egg, but the sting renders the prey utterly inert, and

1. Female blow-flies, netted in the vicinity of the colony on 10th December, 1950, each voided more than 60 vigorous maggots when held with a forceps on a glass slip. On dissecting a gravid female, 62 well-grown maggots were taken from her abdomen. This number would rapidly reduce the larva of the wasp to mere gravy.

there is no struggle. The flies are not required to survive long enough for all to be consumed alive; they are killed outright as is the habit of certain bembecid wasps.

The first damage was observed about the trochanters and the base of the femur of the fly, and it was evident that the soft chitin of the articulation offers least resistance to the initial attempts to eat. Dr. F. X. Williams (1919) observed a similar preference and habit in a sphecid wasp in the Philippine islands¹.

The period for the incubation of the egg appears to range between four and six days, and is no doubt governed by soil temperature, and this variation was also recorded in other genera by Williams.

Just how long the larva takes to consume its twelve or so flies could not be accurately ascertained, but it is somewhere about twelve or fourteen days; not a morsal is left unconsumed to contaminate the amber-coloured silky cocoon.

TEMPERATURE AND HUMIDITY

The temperature of the sand surrounding the cells at the base of the shaft was recorded at regular intervals in an endeavour to determine the optimum conditions for the development of sericophorine larvae.

What few experiments have been made with other insects and recorded by authors seem to indicate that insect development is arrested in the zone between 13.8° and 4.4° C.; the fatal zone up between 35° and the maximum 60° C.; the effective zone being between 13.5° and 35° C. Imms (1931) states that grain-weevils held at between 16° and 27.7° C. required 10 per cent. humidity for their normal development.

It was, therefore, of interest to observe the progress of the sericophorine larvae in the conditions described below, for there was a total absence of the fungal growths that usually defeat attempts to rear the larvae of fossorial wasps and bees in laboratory conditions. The larvae appear to develop better at the lower temperatures.

The sericophorine cells were built at a depth of 37 cm., and at that level a wooden rod was thrust into the moist sand on the vertical "face" of the excavation. A thermometer was inserted in the resulting cavity, and a reading was taken at noon on the dates specified in the table.

1. "The young grub—*Cratolarra pitamaica* Rohver—sucks out its victim's juices, but later . . . devours also the harder parts of its prey's anatomy."

Cocoons which had been dug up on the 15th of April were laid between cotton-wool, and placed in a fibre box measuring 12 cm. by 12 cm. by 5 cm.; that is, the box had a capacity of approximately 720 c. cm. The cover fitted neatly but not air-tight, and the temperature of the interior of the box was maintained, within a degree or two, of that of the soil.

All the female wasps collected by the author at the new "Site 3", during the first half of December, 1950, were smaller, measuring only 10 mm. in length against the 12 mm. of the typical form, yet there is little doubt that every one emerged at and emigrated from the parent colony.

These smaller females are bluer in colour, and the red portions are darker, but a critical study of mounted preparations showed no structural differences, except that of size; they are also less hairy. The uniformity of the females suggests a common law rather than mere chance. This condition was present also in the laboratory specimens.

The differences could be due to any one of several factors¹. One—a detrimental change in the temperature of the soil during a critical period in the development of the larvae. Two—An alteration of the moisture content of the soil. Three—Quantitative and qualitative factors in nutrition. Four—Genetical inheritance. Any one of these factors can affect the size of adult bees. It is difficult to see the incidence of genetical inheritance on the problem because of the numbers of unrelated solitary mothers comprising the parent colony.

Whatever the causal factor might be the taxonomist, unfamiliar with the phenomenon in the field, would almost certainly refer the smaller females to a variety, or even a subspecies of *S. teliferopodus* Raym.

A small female, 7.5 mm. approximately, very close to *S. sydneyi* Raym. was received from Bolgart, Western Australia. It is separated from the normal form by two short stripes of white hair on the mesothorax; two large clypeal teeth, and other trifling morphological differences. This form may be to *S. sydneyi* what the smaller Sandringham forms are to *S. teliferopodus*. Surprisingly, parallel forms of *S. cliffordi* were received also from Gorae West, Victoria. Whether or not these smaller wasps could be due to genetical or nutritional factors was not determined, and until more is known about their origin, the author has referred them to the species mentioned.

1. The pupal stages of these small females were passed during a period of intense sun-spot activity which disrupted radio communications during the latter half of November and the early half of December, 1950. The author is not competent to offer any more than the mere record of the facts.

SERICOPHORINE WASPS

TABLE OF DEVELOPMENT

Sericophorus teliferopodus

15th April, 1950.—Completed cocoons removed from a depth of 37 cm. in sand.
Eggs laid about 1st April.—Larvae do not exhibit any special characters; pale-gray in colour.

Barometer (Inches).	Shade Temperature.	Temperature of Soil.	Moisture Content.	Temperature of Larvae.	Relative Humidity.
30.299	15.0	12.0	25	12.0	28
	1st June.—Larvae had changed from pale-gray to pale-ivory colour.				
29.942	16.5	12.0	20	12.5	29
	15th June.—Larvae showing small lateral swellings.				
..	..	12.0	22	12.0	30
	1st July.—Larvae unchanged.				
30.204	12.0	12.0	20	12.5	31
	15th July.—Larvae unchanged.				
30.512	9.0	12.0	20	12.0	30
	1st August.—Larvae showing small lateral buds.				
29.804	16.8	12.0	20	12.5	30
	15th August.—Larvae showing large lateral buds.				
30.456	15.2	12.0	18	12.5	30
	1st September.—Larvae with a line of eight large dorsal tubercles.				
29.784	12.2	13.0	18	13.5	30
	15th September.—Thoracic tubercles now developed to transverse ridges.				
30.60	13.0	13.5	20	13.5	30
	1st October.—Larvac, with eight large pearly lateral buds, contracted dorsally.				
30.80	16.0	15.3	16	16.0	32
	15th October.—Larvae 5.5 mm. in length, oval in dorsal view.				
30.8	16.0	16.0	15	16.0	33
	1st November.—Larvae expanded dorsally.				
29.61	17.5	16.5	19	17.0	37
15th November.	Larvae conspicuously convex dorsally, with a longitudinal fine dark line.				
29.79	..	17.5	10	16.5	37
	23rd November.—Larval segments deeply defined. Skin somewhat flaccid.				
..	32.0	26.0 at noon, receding to 20 at midnight			98

(An uncomfortable heat-wave passed over the State bringing abnormal conditions).

30th November.—At 3 p.m. the first of the shafts in the field were reopened.

1st December.—Larvae in laboratory unchanged.

29.90	17.0	20.0	7	22.0	89
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(On 3, 4, 5, and 6th of December, 1950, another distressing heat-wave passed over the State, with the shade temperature reading 39° C. The temperature of the larvae in the laboratory rose to 30° C. at noon and receded to 20° C. at midnight. In the field there were, by actual count, over 100 new shafts open on three sites.)

15th December.—Larva often draws in and then extrudes the translucent apical segment; incipient thoracic segments more defined; large oenocytes show as opaque white cells on translucent body.

29.80	24.0	23.0	5	19.5	89
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(On 16, 17, 18, 19th December, 1950.—Yet a third heat-wave swept the State, with shade temperatures reaching 38° C. A violent change on the 20th sent the temperature down to 13° C. and increased the author's difficulties. In the field every shaft was closed, and excavation was not resumed until three days later.)

TABLE OF DEVELOPMENT—*continued*.*Sericophorus teliferopodus*—*continued*.

20th December.—Larvae unchanged.

In the field, the first series of shafts were closing, but at 4 p.m. all tumuli were washed away by a storm.

23rd December.—Larvae in laboratory unchanged.

Many new shafts begun after three days of inactivity.

27th–29th December.—Larvae unchanged.

A fourth wave of heat swept the State; on the 29th a violent storm washed away all tumuli

1st January, 1951.—Larvae unchanged.

In the field, many new excavations and fresh tumuli.

8th–12th January.—Larvae changing.

A fifth wave of heat swept the State, with shade temperatures recording 41° C. A violent storm on the 12th washed away all tumuli.

15th January.—Larvae approaching pupal stage.

Temperature of box crept up to 25° C. at noon, receding to 20° C. at midnight. In the field, many new shafts.

1st February.—Larvae in laboratory changed to pupae.

Temperature of box 29° C. Relative humidity 100 per cent. on 7th February all shafts of third brood closed.

15th February.—Pupa in laboratory almost fully developed, and emerged a few days later. Temperature of box 29° C. Relative humidity 100 per cent.

1st March.—One pupa dead in cocoon.

Temperature of soil 24° C. of box 23° C. Relative humidity 80 per cent.

15th March.—All larvae in laboratory changed to developed pupae.

Temperature of soil 23° C., of box 20.5° C. Relative humidity 80 per cent.

(The summer of 1950–51 was the hottest ever recorded for Melbourne, Victoria, with high humidity. In Sydney, New South Wales, there was the phenomenal precipitation (1949–50) of 151 inches. In the spring of 1951, light falls of snow fell on five occasions during the 9th August at Sandringham: This was unprecedented in the history of the "village". The temperature fell to 2° C. and Melbourne experienced its heaviest fall of snow for 102 years. Snow falls are exceedingly rare on the shores of Port Phillip Bay in Victoria. It should be observed that such remarkable circumstances may have had an acute incidence on this record.) All shafts in the field were closed on 1st May, 1950, but one female was digging the second cell on 13th May, 1951.

BEHAVIOUR OF THE INDIVIDUAL

"The wasp grips her captive between her hind legs, with the tip of her abdomen curved under and forward, as though to support the prey. The fly is carried with its legs uppermost, and the head forward; the wasp walking on four legs, sometimes on five, and occasionally on six."

"About a dozen or thirteen flies are stored in each chamber, and the wasp's egg, like an elongated jelly-bean, is deposited on the breast of one of the flies—the first captured? When I caught a wasp with her fly, there was a moment of frenzied struggling before the prey was dropped; the wasp then departed to hunt for another. This one seemed to be a very teachable individual."—R.F.

1. At Cheltenham, New South Wales, December, 1950, the moisture content of punky wood, in which a colony of *Halictus peraustralis* Ckll. was studied by the author, was found by Norman Rodd to be 72.5 per cent.
2. Frequent and unexpected "cuts" in the supply of coal-gas and electrical energy during the entire period of larval development, reduced the control of temperatures to primitive and much less efficient devices. See note on Graph, Text, fig. 7.

It is probable that the short curved sting of these wasps is used to impale the victim, for this remarkable habit had also been observed in America by Phil. Rau (1918) in his studies of *Paranothyrus*, a species of wasp which stocks its cells with flies. The large salivarium is not conspicuous on the glossa, nor are the ducts of the pharyngeal glands on the pharyngeal plate, and it is improbable that any glandular secretion is added to the animal food of the larvae.

“ The wasps were watched very closely, and to make sure they did not slip in or come out without being recorded, I placed glass tumblers over the shafts. One unexpected angle of the tumbler method developed into an experiment that tested the powers of a female to orientate herself.”

“ For convenience in observing, I wore a pair of grey-coloured ‘ slacks ’, and stood on the west side of ‘ A ’ shaft, and near enough to lift the tumbler as required to permit the wasp to enter and depart. Evidently, the ‘ slacks ’ were regarded as land-marks, for when I moved over to the west of ‘ B ’, the returning wasp immediately darted down the strange shaft with her prey.”

“ I could make no mistake about the wasp, because the tumulus of ‘ B ’ had been flattened by a wheel of an auto-truck some days previously, and our cat had pounced on the wasp, which was probably killed, since it did not return to the nest.”

“ Further proof of deception is provided by the fact that, wherever I moved, the returning wasp invariably flew to me, and orientated herself by the legs of the grey ‘ slacks.’ When other watchers, dressed differently, took up a position to observe, the wasp still followed me, searching for a nest which did not exist. A change of clothes undoubtedly confused her, and she mistrusted strange observers until they, too, donned grey ‘ slacks ’.”

“ The wasps emerge about 10 a.m., and go abroad, perhaps to love and feast; they return to do a little excavating about 1 p.m. and then begin a very busy hunting period for about two hours or more, after which they remain below till next day, when the programme is repeated. The time-table below was compiled on the 13th May, 1950.”—R.F.

There is little doubt that the interval between the cessation of work on the afternoon, and emergence on the following morning, is spent in excavating and draping the second cell, and preparing

it for the reception of the victims of the next hunting. The timetable is almost a duplicate of that for the 12th May, and since it is a characteristic one, and covers the whole of her hunting period for one day, is given in full.

13th May, 1950, at dawn—

Fresh soil had been pushed up overnight into a tumulus.

11.10 a.m. Wasp emerged; orientated site.	11.50 a.m. Dept.
11.12 a.m. Arr. 1st fly.	11.51 a.m. Arr. 7th fly.
11.18 a.m. Dept.	11.52½ a.m. Dept.
11.22 a.m. Arr. 2nd fly.	11.53 a.m. Arr. walked about.
11.26 a.m. Dept.	11.54 a.m. Dept.
11.30 a.m. Arr. 3rd fly.	11.55 a.m. Arr. 8th fly.
11.35 a.m. Dept.	11.57 a.m. Dept.
11.36 a.m. Arr. 4th fly.	12 noon. Arr. 9th fly.
11.40 a.m. Dept.	12.2 p.m. Dept.
11.45 a.m. Arr. 5th fly.	12.8 p.m. Arr. 10th fly.
11.47 a.m. Dept.	12.17 p.m. Dept.
11.48 a.m. Arr. 6th fly.	12.20 p.m. Arr. 11th fly.
	12.23 p.m. Dept. absent for a long period.

1 p.m. Wasp arrived and entered shaft. Shortly after she began to excavate again, pushing up a few pellets to close the entrance. The wasp must have remained below during the rest of the afternoon, for a glass tumbler was placed over the hole.

14th May. The mound of soil was unchanged up to 10 a.m. She then made a hole through the mound as though for an exit, but she did not flutter up into the glass and remained below.

10.40 a.m. The wasp now appeared, and began filling in the shaft by standing in it, and drawing in the pellets of soil from the mound with her front legs until only the outer shell was left, and when it collapsed, she continued drawing in the pellets until only a small ring of soil was left round the shaft."—R.E.

Many larvae were fully-developed by the 22nd April, and they measured 10 mm. in length; the colour being pale bluish-grey, with a dark dorsal stripe; the very small head is creamy-white in contrast, and the mandibles strongly chitinized, and capable of chewing firm material. Large numbers of pale oenocytes are conspicuous in the body-juices. All the larvae are quite white after the mesenteron has been evacuated, and are fully-developed by the end of April; imaginal buds (histoblasts) are conspicuous by the end of May.

The two cells are horizontal, and the larvae are encased in thin oval cocoons woven of amber-coloured silk, covered on the exterior with a coating of clean golden sand, which had been incorporated during the weaving. The threads of the inner silk run round the cocoon in a close spiral. The completed shafts are filled for their entire depth with clean sand.

“ Only a ‘ shell ’ is left standing over the shaft, which the wasp closes by standing vertically in the shaft and reaching for the grains with her forelegs; she presses them down with her hind pair, like a man stamping down wool in a bale.”—R.E.

In Victoria the activities of the females were ended by the 1st May, but the season is much later in Western Australia. Mating takes place over the colony; at least smaller wasps were seen to pursue closely the larger ones. The males are similar to the females, but much smaller, and the apical segment of the flagellum is modified.

The females, it would seem, mate only once. Norman W. Rodd observed the behaviour of the males at a colony which he found in New South Wales. The species proved to be *S. viridis* subsp. *roddi*, and his account is appended.

“ In late December, 1950, at Tallong (elevation approximately 2,000 feet.), I observed a rather scattered colony of the wasps. A dozen or more of the shafts were located in a 50-yard length along a bush-track; some of the entrances were on level ground, but others were in the sides of ruts made by tractor-wheels.”

“ All were in fine red volcanic soil, which was particularly moist, and apparently had been for the greater part under water, owing to the prolonged wet weather experienced in New South Wales during the year.”

“ I spent several hours watching the shafts, and saw a few small wasps making exploratory flights over the surface of the ground, before forcing an entrance down the shafts, all of which were closed with loose red soil.”

“ None of the wasps was seen to carry any prey, and on capturing a number, I was surprised to discover that they were all males. I am forwarding several of these for your investigation.”

“ The females probably had not yet commenced to hunt, but were working down below preparing the cells. The fact that the males were repeatedly seen to enter the shafts would seem to indicate that mating takes place below ground.”

“ Unfortunately, my time was limited, and I was unable to dig out any galleries to confirm this. If the nests could be examined at a later date, say in two weeks time, I believe more reliable information would be obtained.”—N.R.

It would appear, too, that the females of *S. sydneyi* Raym. at least, endeavour to establish “ territorial rights ”, as it were, over specially desirable home-sites, and this behaviour has been observed in other Hymenoptera. Wasps, bees and ants have strong instincts regarding property rights, and will maintain a violent defence of the home site against all trespassers.

Rica Erickson sends the following observation:—

“ The female wasps are quite pugnacious to other insects. On a patch of damp ground, which seemed to hold an attraction for wasp after wasp, one female amused me with her strenuous endeavours to chase other insects away. Even the larger honey-bees were not allowed to loiter. Certainly they did not appear to be greatly frightened by the wasp, but she nevertheless kept them moving. The wasp seemed much too small to be “ bossing ” other insects so effectively, but by flying at the intruders with savage gestures, she ultimately succeeded in scattering and driving them away.”

“ The sexes seem to emerge in late evening or early morning. Four of the shafts opened within twenty minutes, but I placed a glass over the fourth, and obtained a male and a female from another shaft.”

“ The natal shafts are not deserted immediately, for the sexes may return to rest in them for a while, but the females soon commence the new digging, and thereafter the sexes apparently rest in the new shaft, at least, that is what I conclude from my own observations.”

“ I did notice that when I captured a wasp emerging from her natal shaft, and enclosed her in a glass tube, she did not survive the imprisonment for more than an hour or two.”¹

1. The concluding observation has been confirmed by the author in many other Hymenoptera. The irresistible urge to emerge and fly cannot be defeated, for death soon follows delay. An exception is found in certain halictine bees, where the virgins are loath to leave, and simply enlarge the natal chambers to rear their brood. In the absence of the sexual urge there is no departure from the parental home; it is, therefore, the dominant factor in the departure of insects after emergence from the cell. This is demonstrated by the worker-bees of the hive, for all remain in the colony.

The laden females of *S. teliferopodus* fly rather slowly, and not on a level keel, but with the head highest, as though the "stowing of the cargo had made the ship ride low down at the stern."

When captured in the act, the females maintain a loud excited buzzing, and make strong endeavours to force a way through the meshes, levering determinedly with the calcaria and spines against the threads as though to cut through them.

When a female wasp and a female blow-fly were enclosed together in a glass vessel, the two insects appeared to avoid each other. However, the two insects were imprisoned together for twelve hours without either sustaining any damage.

When two female wasps were imprisoned in the jar, they immediately engaged each other, and grappling frenziedly together formed a tight ball. In the clinch, each appeared to be seeking a weak spot in the other's armour to deliver the coup-de-grâce. However, after a second or two, they recognized the character of the opponent, and breaking away, offered no further attack.

Rica Erickson saw two wasps depart from the shafts "A" and "B" when they were first observed, but only one female returned to perform the work of excavating and provisioning each nest. The observer was not certain that "A" and "B" were the natal shafts, but very probably they were; there are two cells to each shaft, and the author has taken a large and a small cocoon, a female and a male, from one nest. The larvae are overwintered in the cells; and the imagines emerge in the following summer.

"On taking out the closely compacted cluster of flies from one chamber, the wasp larvae on one fly was at first making what appeared to be sucking movements while it mouthed a leg, and I wondered whether it would have moved on to the body of the next fly had I not frustrated it by dispersing the other victims. There seemed to be more than one day difference in the age of the larvae from the two cells in the one shaft."—R.E.

1. (The hunting of the wasps appears to be correlated to the mating habits of the blow-flies. On certain mornings, at 5 a.m., the author observed numbers of flies copulating, and the wasps busily returning with captured males. On other mornings, when the flies were not mating, the wasps visited gum-blossoms, which were secreting nectar copiously. When the flies were mating, the blossoms lacked nectar. Very subtle relationships are indicated, but a heat-wave dominated the State of Victoria on December 2, 3, 4, 5, 6, 7, and the atmospheric conditions were abnormal.)

In several of the cells investigated by the author at Sandringham there was a similar compact mass of heads, thoraces, and abdominal terga, but all were empty, as though they had been sucked dry. It would seem that at first the larval wasp sucks the juices from the prey, but after the mandibles are chitinized, it is then able to attack the harder portions, for there are no disjecta membra in the cells with the cocoons. Where the chitinous "shells" were present there was, of course, no larval wasp, and it was postulated that it had been consumed by a parasitic mutillid which was taken from several other cells.

PARASITES

The mutillid parasites were most in evidence during March and April, and they are of very conspicuous colours not altogether unlike those of the wasp, for the head is black, the thorax red like the legs, and the abdomen a lustrous purple. A small black male caught flying over the site is probably the other sex, for the two are often quite unlike in this genus. Another small mutillid was present, but was not determined.

A small ant of similar size and colour—identified by John Clark as *Melophorus iridescens* Emery,—was frequently observed ranging about the moundlets, but its incidence on the biology of the wasp is unknown. Rica Erickson also mentions an ant about the nests.

The author could find no record of the blue-spotted parasitic bee *Crocisa lamprosoma* Rad., from any locality south of the Dividing Range, for its known hosts, anthophorid bees, are rare in Southern Victoria. He was, therefore, astonished on Monday, 30th January, to net a robust female busily investigating the shafts of the wasps; the temperature was 33° C. It is suggested that the *Crocisa* was searching for shafts of *Anthophorae*, but an assistant says she saw the parasitic bee emerge from a shaft. A month later the cell was excavated, but only a mutillid was in occupation. Collembolans, *Arrhopalites?* are sometimes present in old cells.

A large black bombyliid fly, in the genus *Systoechus*, also dawdles among the shafts, and there is little doubt that she is parasitic; there is some evidence that she utilizes the captives of a quite unrelated wasp, for the author found a number of her larvae on a paralyzed spider. These flies frequent garden flowers for a sip of nectar.

A pompilid wasp of grayish-black colour, with orange-coloured legs and antennae and clouded wings, will descend the open shafts of the wasps, and excavates at the base a crude cell which she stocks with spiders. An arachnid was taken out of one shaft with the young pompilid larva just about to commence its meal.

A small fly, identified by Dr. C. H. Curran as probably *Hylemya urbana* Malloch, also wandered about the entrances.

A minute acarine mite was removed with some pollen-grains from one wasp, and in April, 1951, another mite was found in a cocoon containing a dead wasp.

It was identified by Mr. H. Womersley as *Tyrophagus putrescentiae* Schk¹.

NOTES ON A SPECIES IN NEW SOUTH WALES

Sericophorus viridis roddi, Raym.

Observations on the subspecies were carried out by Norman W. Rodd on the 14th January, 1951, at Cheltenham, 15 or so miles north of Sydney.

"The holes which I located were in sandy soil, or in sandy ground containing a very small proportion of clay, but really heavy ground is avoided."

"The first shafts were more or less what I would call 'solitary'; i.e. no other shaft was in the near vicinity. The second shaft was one of a group of four, occurring over a few yards square."

"Each shaft was surrounded by a fairly substantial 'volcano' of soil. The shafts descend more or less vertically to a maximum depth of 7 to 8 inches, and are quite unlined. The cells were about 5 inches to 6½ inches down, and they too were free from any lining."

"In No. 1 shaft I found five separate cells disposed around the main shaft at various levels, and separated from it by short tunnels 1 to 2 inches in length, but these had been filled with sand. The cells had a diameter of approximately 10 millimetres and were pear-shaped."

"I took a number of flies from each cell, and they appear to be of different species and families, and, in every case, the larvae were in early stages, attacking the fly on the ventral junction of the head and the thorax. The contents of the cells were sent to you in the hope that the wasp-larvae survived the journey."—N.R.

The contents of the five cells arrived during another heat-wave in Victoria; all the wasp larvae had been de-hydrated, and were mere mummies. The flies, too, were dead, but in good condition for identification. One fly in each cell had been attacked near the articulation of the anterior coxal segment, and apparently that is the position favoured by the genus *Sericophorus*.

1. A number of mites taken from another fossorial wasp, *Bembex* sp., proved to be a species of *Pymcphorus*, a genus closely allied to *Pediculoides ventricosus*, the chaff-itch mite.

The author made a microscopic examination of all the prey, and confirmed his observations on *S. teliferopodus* Raym.—only male flies are captured to store the cells. The victims appear to be killed outright, but if they are not, then life is so reduced that it cannot be detected.

It would appear that the largest number of flies, (7) is provided for female larvae, and the smaller number (4 or 5) yields sufficient sustenance for the males, thus conforming to a general law of the HYMENOPTERA. It will be observed that all the flies are well-known pest species in the family MUSCIDAE.

Although the morphological characters of the adults are often extremely critical, it is interesting to discover that the habits, and the "prey", are widely divergent in wasps so nearly alike morphologically as *S. viridis roddi* and *S. teliferopodus*. This phenomenon amply justifies the critical determinations of the taxonomist. It is probable that *roddi* will later be raised to full specific rank when the biology of *S. viridis* is known.

SHAFT No. 1.

Cell

- A. Seven small metallic-green males, *Lucilia argyricephala* Macq.
- B. Seven small metallic-green males, *L. argyricephala*.
- C. Five small metallic-green males, *L. argyricephala*.
- D. Two green males, *Luc. arg.* Two greyish flies, *Musca convexifrons* Thoms. and *Calliphora tibialis*.
- E. Four green males, *Lucilia argyricephala*.

SHAFT No. 2.

- A. Seven small brownish-grey blow-flies, *Calliphora tibialis*.
- B. Five small brownish-grey flies. Four *Calliphora tibialis*, 1 *Musca vetustissima*.

Froggatt 1917 described a wasp, 8.5 mm. in length, *Stizus turneri* Frogg., which attacks the small bush-fly, *Musca corvina*. "The wasp flattens its wings, and then jumps on the prey, killing it in one act." He names another species of *Stizus*, and also a species of *Nysson*, as preying on flies, and thought that the prey was taken down into earthen burrows, although he did not discover the nests.

The second wasp attacked another fly, *Pychosoma (Calliphora) varipes*, on the backs of sheep. The same author relates that sheep-farmers, in the Riverina district of New South Wales, had reported to him that the wasps had been observed to attack and carry off the much larger blow-flies, but Froggatt doubted this, and suggested that such small wasps would be unequal to the task.

It is probable that the insect observed by the pastoralists was a much larger and stronger *Sericophorus* attacking the blowflies, but as Froggatt did not know the habits and the prey of *Sericophorus*, he apparently concluded that the pastoralists had been mistaken.

The robust females, 23 in number, taken from a blow-fly trap on Black Mountain, Canberra, A.C.T., by Doctor I. J. Mackerras, C.S.I.R.O., all proved to be in the subspecies *S. relucens nigricornis*, but there is no information as to which species of fly, if any, were in the trap, or whether the wasps had been enticed into the trap by the presence of the prey.

The only record of the prey taken by *Anacrucis* is attached to the type of *A. punctuosa* Raym. The wasp had been pinned alongside a small tachinid fly, and the legend read—"Wasp with prey." It is thus evident that fly-catching is also a habit of species in this genus.

ECONOMIC VALUE

These iridescent wasps are of considerable economic importance, since they hunt and destroy numbers of blow-flies which are serious enemies of man and his domestic animals.

The largest species, *S. teliferopodus*, Raym., at Sandringham, preys on the common golden-haired blow-fly, and since a dozen or more flies are required to stock a single cell, the wasp colony of 50 shafts, each with two cells, almost certainly destroyed more than 1,200 blow-flies in a day or two. Less than three weeks are spent in excavating and provisioning one shaft with its two cells.

It is probable that each female excavates several shafts during the season, that is, she could provision six or more but even at the lowest figure, she would require 144 flies for her progeny, and the entire colony of 50 or more wasps the astonishing total of 7,200 blow-flies.

In Western Australia, Rica Erickson counted twelve bush-flies as they were being taken down a shaft by *S. sydneyi*, Raym. Later, she took two more from the same wasp, which was observed to drop yet another victim, so that the observed number carried by one wasp was fifteen flies.

However, the circumstances in that case were abnormal, but even at the conservative estimate of twelve flies for each cell, a colony of the wasps is a valuable factor in the biological control of blow-flies in Australia.

The study of the pollen-grains adhering to the mouth-parts demonstrated that the insects favour the Myrtaceous plants, for only one or two females had visited species outside that family. The wasps apparently obtain sufficient pollen and nectar for a meal from one plant, and only occasionally were two kinds of grains present on one wasp. The females confine themselves to certain plants for that reason, but should the supply available be insufficient for their immediate needs, they then seek another myrtle.

It has been contended that since both the wasps and the flies are indigenous species, a delicate balance of nature has been established over aeons of time, consequently, the biologist can do little to increase the wasp populations.

But that is not the position facing the pastoral industry in Australia to-day. The introduction of the sheep, and subsequent increase in the numbers of flocks, has brought about a major

dislocation of the balance of nature by providing an unlimited supply of food for the flies, which rapidly increased to disastrous proportions.

The sericophorine wasps were probably the chief agents in the biological control of the blow-fly during the era of the emu and the kangaroo. Then, suddenly, the wasps were overwhelmed by sheer weight of numbers, and the stable balance of nature was destroyed.

It will never be restored until the wasp population is sufficiently numerous to re-establish its control of the flies. The author is convinced that such a desirable objective could be attained by implementing the following policy—

- A. Establish small breeding areas or sanctuaries (an acre or so) in each district.
- B. The introduction to, or "seeding" of the most valuable species in such areas.
- C. Protection of the areas from destructive agents, such as fire and flood, earth-works and the cultivation of the soil, the exclusion of animals which could destroy the shafts of the wasps, the broadcasting of poisons. (The remarkable pulvilli on the tarsi of sericophorine wasps render them singularly susceptible to poisons such as D.D.T., which rely on contact with the feet of insects for their efficacy. The Hymenoptera are all susceptible.
- D. The cultivation in such areas of the botanical species favoured by the wasps.

It is hardly necessary to stress the fact that no fears need arise regarding the increased numbers of the wasps, for there is no danger to man or any of his animals, either from individual insects, or concerted attack by the colony.

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EXPLANATION OF PLATE 1.

1. Mouth-parts of female wasp, *sericophorus teliferopodus*, sp. nov.
2. Pharyngeal plate and rods showing the ducts of the pharyngeal glands.
3. One of the 24 organs on the anterior margin of the glossa.
4. One of the short broad setae of the glossa.
5. Portion of the web of chitinous rods on the pulvillus of the tarsus.
6. Lateral view of the genitalia of the male wasp, *S. viridis* subsp. *roddi*, Raym.
7. Clavate antenna of the female.
8. Fourth and fifth tarsi with large pulvillus—ventral view.
9. Portion of pulvillus showing its wavy structure.
10. Oblique view of tarsi and pulvillus with the small claws retracted.
11. One of the claws.
12. Spiculae on tibia of male, *S. viridis* subsp. *roddi*.
13. Abdomen of female wasp.
14. Rugose channel of metathorax of female *S. teliferopodus* (compare with No. 6 in the text-fig.).
15. The short curved sting of the female indicates close contact with the victim.
16. Nodose anterior margin of the female clypeus.
17. The strigilis does not differ in the sexes.
18. Labrum of male, *S. viridis* subsp. *roddi*.
19. Median and apical segments of male flagellum.
20. Mandible of female—that of the male is more acute.
21. Anterior wing of female.
22. Posterior wing.
23. A myrtaceous (*Eucalyptus?*) pollen-grain taken from aesophagus of female.
24. Second (morphological) abdominal sternum of female.
25. Oblique view of apical segment of male flagellum.
26. Tessellate and punctate sculpture of the mesothorax.
27. The long and short calcariae of the hind tibiae have a parallel in the bee *Goniocolletes*.

(All parts are more or less distorted by pressure of the cover-glass on the mounted preparations.)

EXPLANATION OF PLATE 2

1. Fly, *Musca vetustissima* Walk., prey of the wasp *S. sydneyi*, sp. nov.
2. Wing of the eastern fly, *Anastellorhina (Ncopollenia) stygia* Fabr.
3. Wing of prey of smaller wasp. (Both wings drawn at same magnification.)
4. Arista of the western fly is plumose on the apical half; that of the eastern fly plumose for its entire length.
5. The slender leg of the fly is defenceless against the strongly-spined leg of the wasp.
6. The parasitized cell of the wasp is filled with the disjecta membra of flies.
7. Female *S. sydneyi* carrying the fly under her abdomen.
8. Larva of wasp in its cocoon (anterior dorsal view).
9. Sandy cocoon of the larva.
10. Portion of cocoon viewed by transmitted light to show grains of sand.
11. Silken threads are woven in a close spiral on the inner surface.
12. Lateral view of scutellum of *S. sydneyi* showing the large tubercle.
13. The spinose pygidial plate of the wasps, when bent forward under the abdomen, assists in holding the prey.
14. The granular sculpture of the mesothorax of *S. sydneyi* (compare fig. 26, pl. 1).
15. The hamuli of the wasps lack the strength of those of bees.
16. Mesh of silk threads in cocoon more highly magnified.

17. The coarse spines and antenna-cleaner of the anterior basitarsus of the wasp.
18. Structure of the prosternal furcae of the wasp.
19. Costal margin of wing of fly.
20. The appearance of the glossa of the fly, at low magnification, is not altogether unlike the web of the wasp's pulvillus.
21. Costal edge of wing of the wasp.

EXPLANATION OF PLATE 3

1. Adult female *Sericophorus nigror* Raym. with the highly flexible abdomen thrust forward to attack with the sting.
2. Anterior view of head-capsule of female.
3. Posterior view of head-capsule of *S. sydneyi* Raym.
4. Egg of *S. sydneyi*; larva within almost ready to hatch out.
5. Ventral surface of male fly, *Musca vetustissima*, with egg of the wasp adhering to episternum.
6. Tarsal rake or comb of female *S. nigror*.
7. Tarsal rake of female *S. teliferopodus* Raym.
8. Pygidial plate of *S. victoriensis* Raym.
9. Pygidial plate of *S. nigror* Raym.
- 10-11. Two oblique views of the modified apical segment of flagellum of female *S. sydneyi* Raym.
12. Seventh sternum of male *S. violaceus* Raym.
13. Sixth sternum of male.
14. Tarsal rake of male.
15. Fifth sternum of male; note irregular line of the gradulus.
16. Lateral view of genitalia of male *S. violaceus*.
17. Posterior dorsal view of genitalia.
18. Seventh abdominal tergum with pygidial plate.
19. Wing of mutation showing the duplication of the second recurrent nervure.
20. Mite *Tyrophagus putrescentiae* Schk. taken with pollen from mandibles of *S. teliferopodus okiellus* Raym.
21. The dentate margin of the penis-valve of *S. violaceus* Raym. X. 600. (Compare with fig. 6, pl. 1).

EXPLANATION OF PLATE 4

Epinotum of species in the genus *Sericophorus*; the small circle shows the sculpture of the dorsum. All are presented in oblique dorsal views to show the declivity.

1. *S. bicolor* Sm. The sculpture of the small dorsum is masked by circular tufts of hair.
2. *S. nigror* Raym. The declivity of the long epinotum is masked by pale hair, but the dorsum is finely rugose.
3. *S. spryi* Raym. is close to *S. violaceus*, but is much smaller.
4. *S. rufipes* Raym. The declivity has a number of small transverse carinae below the incisure.
5. *S. claviger* Kohl. has deep pits laterally, but is small.
6. *S. relucens* Sm. has the scutellum and postscutellum red.
7. *S. teliferopodus* Raym. is the largest species.
8. *S. chalybaeus* Sm. The lateral margin is deeply pitted, and the rugae tend to extend over the declivity and dorsum.
9. *S. pescotti* Raym. has the scutellum and postscutellum black.
10. *S. victoriensis* Raym. and *S. subviridis* Raym. have a similar sculpture on the epinotum.

11. *S. violaceus* Raym. has only a few large pits laterally.
12. *S. gracilis* Raym. has a peculiar short incisure.
13. *S. viridis* Sauss. is near to *S. teliferopodus* Raym.
14. *S. sydneyi* Raym. has very fine carinae laterally.

Comparative sizes are indicated by the amount inclosed in the field of a 1-in. objective. In *pescotti* the entire thorax is included; only the margin of the scutellum appears in *viridis*, but almost the full length of it in *violaceus*.

EXPLANATION OF PLATE 5

Structure of propodium of species in the genus *Sericophorus*. The small circle shows the sculpture of the dorsum.

1. *S. brisbanensis* Raym. is small, but has large "honey-comb" rugae.
2. *S. castaneus* Raym. has larger pittings.
3. *S. cyanophilus* Raym. has only a few coarse rugae laterally.
4. *S. elegantior* Raym. is slender with a few coarse rugae.
5. *S. hackeri* Raym. approaches *S. brisbanensis*.
6. *S. inornatus* Raym. has fine inconspicuous rugae; the cruciform incisure is hardly defined. *Left*—the compressed tubercle of the scutellum is similar to that of *S. subviridis* Raym.
7. *S. lilacinus* Raym. has numerous fine rugae.
8. *S. metallescens* Raym. is close to *S. rugosus*, but is much smaller, and the incisure hardly defined.
9. *S. subviridis* Raym. has many fine rugae.
10. *S. rufobasalis* Raym. has few rugae, but much white hair.
11. *S. rugosus* Raym. has coarse rugae over the entire surface, and the bar of the incisure is hardly defined. (Compare with No. 8.)

EXPLANATION OF PLATE 6

1. The dorsal tubercles and eight lateral "buds" of the larva were unchanged for 154 days. (See text-fig. 3, No. 3, for early larval stage on 1st May.)
2. Oblique dorsal view of larva on 20th October; it measured only 5.5 mm. in length.
3. On 15th September, the dorsal surface was contracted, and the ventral surface expanded.
4. At a later stage, 28th November, the ventral surface was contracted, and the dorsal surface greatly expanded.
5. The translucent apical segment is frequently retracted and extruded just before the pupal change about 3rd January.
6. The dorsal nodes had developed to bi-tuberculate ridges by the above date.
7. Outline of an incipient abdominal segment showing the lateral "buds" being absorbed 10th December. The adult stage was reached about the 1st February.
8. Genitalia of *S. chalybaeus* Sm. 8A. Serrated process more highly magnified.
- 9-9A. Apical plates of abdomen of male *S. chalybaeus* Sm.
10. Pore-organs at articulation of trochanter *S. relucens* Sm. X. 600.
11. Oblique view of genital capsule of male blow-fly, *Neopollenia stygia* Fabr.
12. Portion of gland from male fly—5 cm. approximately in length; the entire alimentary canal was only 25 mm. in length.
13. Several of the lobules more highly magnified.
14. Three of the lobules magnified X. 600.
15. Clypeal teeth of male *S. chalybaeus* Sm.

By the serrated process of the genitalia and the apical sternum of *S. chalybaeus* Sm., the species is related to *S. violaceus* Raym. and *S. rufotibialis* Raym.

EXPLANATION OF PLATE 7

1. Adult male *Astaurus hylaeoides*, gen. et. sp. nov.
2. Front view of the head capsule.
3. Sculpture of the dorsum of the epinotum, oblique view.
4. Genitalia.
5. Hind tibia, with spiculae and calcariae.
6. Seventh abdominal sternum.
7. Ninth abdominal sternum.
8. Seventh tergum with pygidial plate.
9. Tarsi of anterior leg.
10. The strigilis of anterior leg has a short broad malus, and a mere line of hyaline velum.
11. At the base of the scapes is a pair of sharp teeth.
12. The nine hamuli are strongly developed.
13. The mandible of the male has a yellow spot near the base.
14. The close coarse punctures of the abdominal sterna.
15. One of the simple hairs.
16. The claws of the tarsi are simple.
17. Scattered piliferous punctures of the mesothoracic disc.
18. Lateral view of the epinotum of male.

EXPLANATION OF PLATE 8

1. Fourth abdominal sternum of *Sericophorus tallongensis* Raym. Note the small curved gradulus.
2. Fifth sternum of *S. cliffordi* Raym. lacks the gradulus.
3. Fifth sternum of *S. tallongensis* Raym.
4. Seventh sternum of *S. cliffordi* Raym.
5. Seventh sternum of *S. tallongensis* Raym.
6. Antennae of male *S. cliffordi* Raym. Note the twelve segments similar to those of the female.
7. Portion of a segment of the male flagellum more highly magnified to show three kinds of organs. A. View of C. from above. B. One of the small dark hairs. C. Lateral view of one of the largest organs X. 700.
8. Genitalia of *S. cliffordi* Raym. are distinct by the large serrated processes of the claspers.
9. One of the serrated margins more highly magnified to show—D. Large teeth, and E. small teeth.
10. Genitalia of *S. tallongensis* Raym. are remarkable for the large ventral processes and the minute serrations of the claspers.
11. One of the "claspers" more highly magnified.
12. Some of the "teeth" of the serrated margin X. 700.
13. The teeth of the claspers in genitalia of *S. violaceous* Raym. are very regular.
14. Sixth sternum of *S. cliffordi* Raym.
15. Portion of galea showing the inner comb and dark bands of *S. teliferopodus* Raym.
16. Anterior view of emarginate glossa of female.
17. A few of the pollen-grains removed from *S. rufitibialis* Raym. were not of the Myrtle family, and may have been accidental contamination.
18. Anterior margin of clypeus of female *S. cliffordi* Raym. has three nodules, counting that of the angle.
19. Anterior margin of the male clypeus lacks teeth.
20. One of the ovarian tubules of female *S. teliferopodus* Raym. showing eggs at various stages of development.
21. Three views of the modified apical segments of flagellum of male *S. tallongensis* Raym. The flagellum of male *S. cliffordi* is not modified.

EXPLANATION OF PLATE 9

1. Dorsum and lateral carinae of epinotum of female *S. occidentalis* Raym. (The small circles represent the sculpture of the dorsum.)
2. Epinotum of male *S. cliffordi* Raym.
3. Epinotum of female *S. relucens nigricornis* Raym.
4. Epinotum of female, *S. froggatti* Raym.
5. Epinotum of male, *S. tallongensis* Raym.
6. Dorsal view of genitalia of male, *S. rufobasalis* Raym.
7. Lateral view.
8. Serrations more highly magnified to show wide and narrow spacing of the teeth.
9. Anterior wing of female with only two cubital cells.
10. Mesophragma of male; oblique lateral view.
11. Posterior view.
12. Clypeal teeth of female *S. occidentalis* Raym.
13. Clypeal angles of male *S. tallongensis* Raym. (Absence of nodular teeth is an excellent sex-character of males in this genus.)
14. Clypeal teeth of female *S. cliffordi* Raym.
15. Clypeal teeth of female *S. relucens nigricornis* Raym.
16. Apical sternite of male *S. rufobasalis* Raym.
17. Clasper of genitalia more highly magnified.
18. Genitalia of *S. claviger* Kohl., oblique view.
19. Apical sternite of male.
20. Clasper of genitalia more highly magnified.
21. Serrated process more highly magnified.
22. Apical segments of flagellum of *S. rufobasalis* Raym.

EXPLANATION OF PLATE 10

1. Genital capsule of male wasp, *Sericophorus hackeri* Raym.
2. Eighth abdominal sternum.
3. Clasper (penis valve).
4. Serrated margin of clasper more highly magnified.
5. to 8. *S. spryi* Raym.
9. to 12. *S. rufotibialis* Raym.
13. to 16. *S. brisbanensis* Raym.
17. to 20. *S. minutus* Raym.
21. to 24. *S. claviger burnsiellus* Raym.
25. to 28. *S. metallescens* Raym.
29. Fourth abdominal sternum *S. spryi* Raym. Note the almost straight gradulus.
30. Seventh abdominal sternum *S. claviger burnsiellus* Raym.
31. Seventh abdominal sternum *S. rufotibialis* Raym.

(All homologous parts are shown in the same relative position, and drawn at the same magnification. There is some deformity due to pressure by the cover-glass.)

EXPLANATION OF PLATE 11

No. 1 indicates the site of the original colony of 50 shafts observed in 1949. The wasps continued their occupation during 1950-51.

No. 2 colony, across the road, was founded in 1950, and worked in 1951.

Nos. 3 and 4 were founded in 1951, and all were derived from the parent colony. It will be seen that the four colonies are established on the eastern and the northern sides of a "square" of houses, and so receive the full warmth of the sun, and also the hot wind of summer. They are, however, well sheltered

from the cold winds, not only by the houses, but also by a row of trees, *Eucalyptus botryoides*, perhaps 30 feet tall, along the western border. All of the other trees surrounding the rectangle are *E. ficifolia*, *E. calophylla*, and *E. leucoxyton*, some 5 feet tall. There are thickets of tea-tree, *Leptospermum laevigatum*, say, 5 to 15 feet tall, growing in the angles of the large "corners" of the area. There is, therefore, an abundance of nectar and pollen for the wasps.

The position of the colonies, indicated by black dots, shows that the wasps crossed the bitumen road on two occasions, to dig in the soft sand of the "nature-strips" bordering the roadway.

Experiments in breeding these wasps should no doubt be conducted in "sanctuaries" having a similar aspect, since it is preferred by the insects.

EXPLANATION OF TEXT-FIGURE 1

Pollen-grains removed from the mouth-parts of sericophorine wasps.

1. <i>Godetia</i> sp.? (garden)	<i>S. spryi</i> Raym.	Mordialloc, V.
2. <i>Tristania conferla</i>	<i>S. gracilis</i> Raym.	Glen Aplin, Q.
3. Leguminous sp.	<i>S. teliferopodus</i> Raym.	Carrum, V.
4. <i>Eucalyptus</i> sp.	<i>S. gracilis</i> Raym.	Glen Aplin, Q.
4. <i>Melaleuca ericifolia</i>	<i>S. chalybaeus</i> Sm.	Wannon, V.
6. <i>Melaleuca</i> sp.	<i>S. viridis</i> subsp. <i>roddei</i>	Lane Cove, N.S.W.
7. <i>Leptospermum</i> sp.	<i>S. teliferopodus</i> Raym.	Noble Park, V.
	<i>S. viridis</i> Sauss.	Mt. Victoria, N.S.W.
8. <i>Kunzia ambigua</i>	<i>S. claviger</i> Kohl.	Woollahra, N.S.W.
9. <i>Isopogon</i> sp. or <i>Goodenia</i> sp?	<i>S. viridis</i> subsp. <i>roddei</i>	Sydney, N.S.W.
10. <i>Melaleuca</i> sp.	<i>S. viridis</i> subsp. <i>roddei</i>	Sydney, N.S.W.
11. <i>Leucopogon</i> sp?	<i>S. teliferopodus</i> Raym.	Cheltenham, V.
12. Myrtaceous sp.	<i>S. viridis</i> Sauss.	Wynyard, Q.?
13. Myrtaceous sp.	<i>S. lilacinus</i> Raym.	Wynyard, Q.?
14. Bot. sp. unknown Com- posite?	<i>S. teliferopodus</i> Raym.	Beaconsfield, V.
15. <i>Pimelia</i> sp?	<i>S. teliferopodus</i> Raym.	Beaconsfield, V.
16. Leguminous sp?	<i>S. lilacinus</i> Raym.	Wynyard, Q.?
a. <i>Hakea</i> sp.?	<i>S. lilacinus</i> Raym.	Wynyard, Q.?

EXPLANATION OF TEXT-FIGURE 2

1. Lateral view of thorax of *Sericophorus violaceus* Raym.
2. Wing of mutation of *S. spryi* Raym. with only two cubital cells.
3. Apical segment of flagellum of *S. claviger burnsiellus* Raym.
4. Mandible of *S. rufobasalis* Raym.
5. Clypeal margin of *S. rugosus* Raym. has only the tooth of the produced angle.
This form is similar to that of *S. hackeri* Raym.
6. The angle is sharper in *S. claviger* Kohl. and the tooth is practically obsolescent in *S. rufobasalis*.
7. Clypeal margin of the northern race of *S. relucens* Sm. has three teeth.
8. *S. pescolti* Raym. is emarginate with only two teeth.
9. *S. palongensis* Raym. has three subequal teeth.
10. *S. elegantior* Raym. has three small teeth.
11. The nodular teeth of *S. metallescens* Raym. are conjoined.

12. The nodules of *S. cyanophilus* Raym.
13. Apical segment of flagellum of *S. relucens* Sm. (topotype).
14. The tarsal comb of *S. cyanophilus* Raym. has seven long spines.

EXPLANATION OF TEXT-FIGURE 3

1. Tumulus of sand excavated by female *Sericophorus teliferopodus* Raym.
2. Base of shaft with its two galleries; the cell contains a cocoon.
3. Larva with remnants of its meal on the ventral surface.
4. Mandible of the larva.
5. The numerous pale oenocytes are conspicuous in the dark body.
6. The rugose structure of the female *S. patongensis* Raym. (Compare with No. 11, pl. 5.)
7. Apical segment of the male flagellum.
8. The parasitic bombyliid fly in the genus *Systoechus*.
9. Antenna of the fly.
10. Haltere of the fly.
11. The larvae of the wasp may have many stiff black hairs.
12. The fly has a number of black and white scale-like hairs arranged in bands.
13. The parasitic mutillid wasp in the genus *Euphutomorpha* is brightly coloured.
14. Rain often cements a ring of sand on top of the tumulus.
15. There are three nodules laterally on the clypeus of *S. chalybaeus*, Sm. (Compare with No. 16 in pl. 1.)

EXPLANATION OF TEXT-FIGURE 4

Homologous structures in Bees and Wasps.

1. Five tarsal segments of a bee *Paracolletes paradoxus* Raym. (in M.S.).
 2. Outer surface of five tarsal segments of a wasp, *Bembex tor* (in M.S.).
 3. Inner surface. Males of *Megachile* often have black lines and dots.
 4. Five tarsal segments of a bee, *Megachile lineatipes* Ckll.
- "B." indicates the tarsal brush, and the arrow the comb of the antenna-cleaner.

EXPLANATION OF TEXT-FIGURE 5

1. Metathorax of *Anacrucis laevigata* Raym. (the small circle illustrates the sculpture of the dorsum).
2. Metathorax of *A. striatula* Raym.
3. Anterior wing of female.
4. Subfiliform antenna of *A. laevigata*.
5. Clypeus and nodular teeth of *A. striatula*.
6. Vertex of head-capsule of female.
7. Attachments of indirect vertical wing muscle to the chitin of the scutum.
8. Bituberculate swelling on frons of *A. laevigata*.
9. Anterior margin of clypeus of female.

EXPLANATION OF TEXT-FIGURE 6

1. Metathorax of *Anacrucis punctuosa*, sp. nov.
2. Metathorax of *A. asperithorax*, sp. nov.
3. Metathorax of *A. clypcata*, sp. nov.
4. Emarginate clypeus of *A. clypcata* and the teeth resemble those of *Megachile*.
5. Compressed apical segment of flagellum of *Sericophorus relucens nigricornis*.
6. Remarkable toothed median segments of antenna of a mutation.
7. Wing of a fly, prey of *Anacrucis punctuosa*.
8. Arista of fly.
9. Haltere of fly.

EXPLANATION OF TEXT-FIGURE 7

Graph showing minimum and maximum periods of excavation by a large "Colony" of wasps, *Sericophorus teliferopodus* Raym.

The data for the graph was obtained during the two active seasons of 1950, 1951, 1952, which were very remarkable years, for heavy precipitation in 1950 frequently washed away all traces of the yellow tumuli, creating insuperable difficulties in the daily enumeration of the shafts.

The summer of 1951 was marked by the highest temperatures ever recorded for the State; almost every week a wave of heat, often registering well over 100° F., was terminated by violent storms. The torrential rains brought all excavation to a halt, consequently, on a fine morning, large numbers of tumuli would suddenly appear, hence the vertical rises from zero.

This may not be the normal order, but daily observation of shafts marked with metal rings, showed that it is very probably the normal cycle.

EXPLANATION OF TEXT-FIGURE 8

1. Oblique view of dorsum of epinotum of female *Anacrucis ferruginea*, Raym.
2. Anterior margin of clypeus with two nodular teeth.
3. Tarsal comb of anterior legs.
4. Strigilis of anterior leg.
5. Conical apical segment of female flagellum.
6. Oblique view of dorsum of epinotum of female *A. cingulata* Raym.
7. The fine spines of the pygidial area.
8. Tarsal comb of anterior legs.
9. Sting apparatus of female *A. asperithorax* Raym.
10. Sensory organs at tip of gonostylus.
11. One of the sensory organs at X. 700.
12. In the mandibular notch of a female *Anacrucis* was portion of a fly's leg.

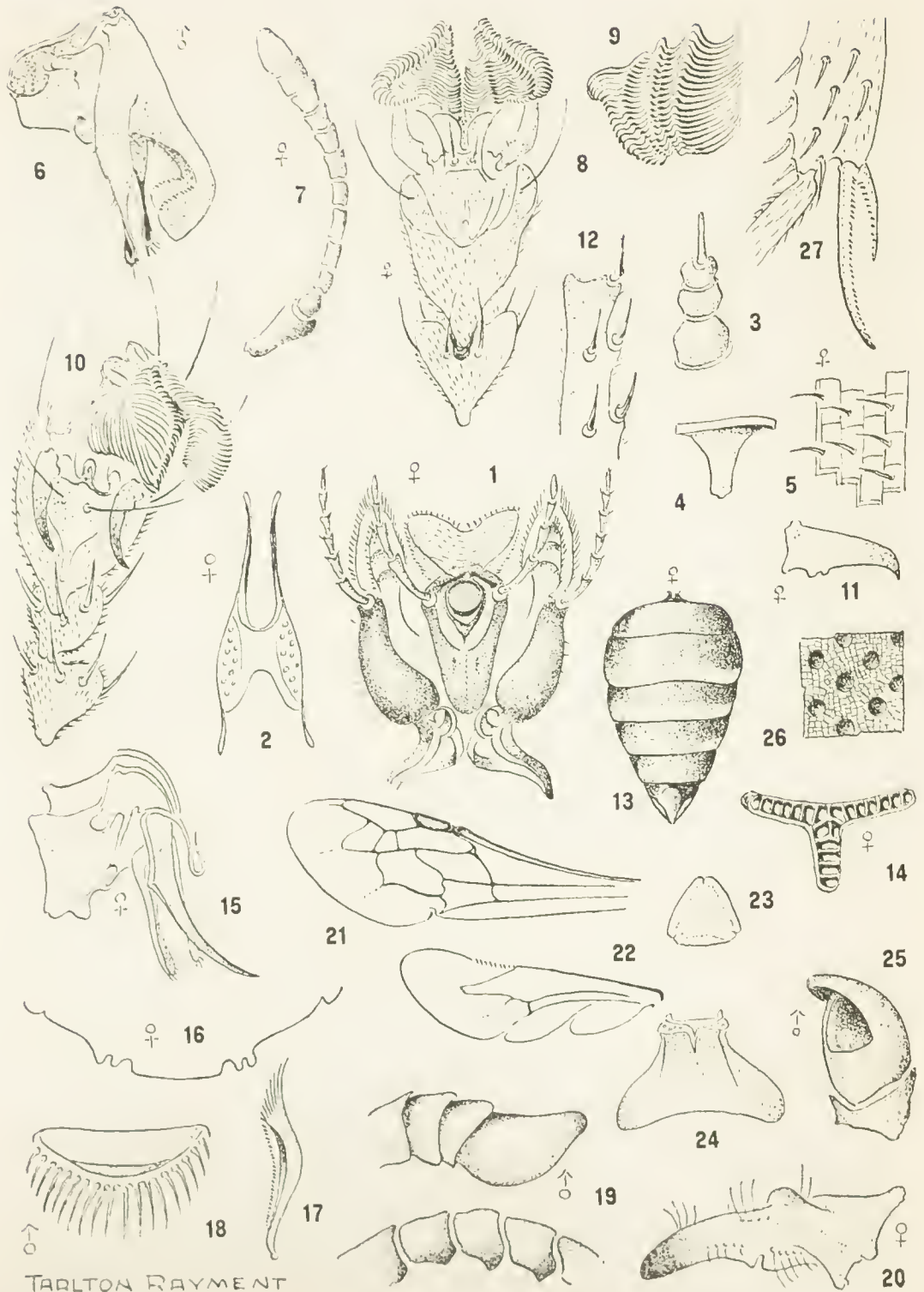
EXPLANATION OF TEXT-FIGURE 9

ORIENTATION OF SANCTUARIES

A survey of several colonies of wasps demonstrated that, where the cold winds blew from the South and West, the insects selected an aspect sheltered on those sides, with the East and the North open, especially to the morning sun.

The trees for the wind-break, and also the lower shrubs, should be chosen from the list of plants visited by the wasps. It will be seen that the botanical family MYRTACEAE is most favoured, and local species should be planted.

Such "Sanctuaries" should have an area of approximately 1 acre, enclosed with a rabbit-proof fence, until the colony is established. The wasps will naturally extend to other suitable areas. The orientation figured here will conform with the conditions indicated in plate 11.



TARLTON RAYMENT

PLATE 1. Details of wasp *Sericophorus teliferopodus* Raym.

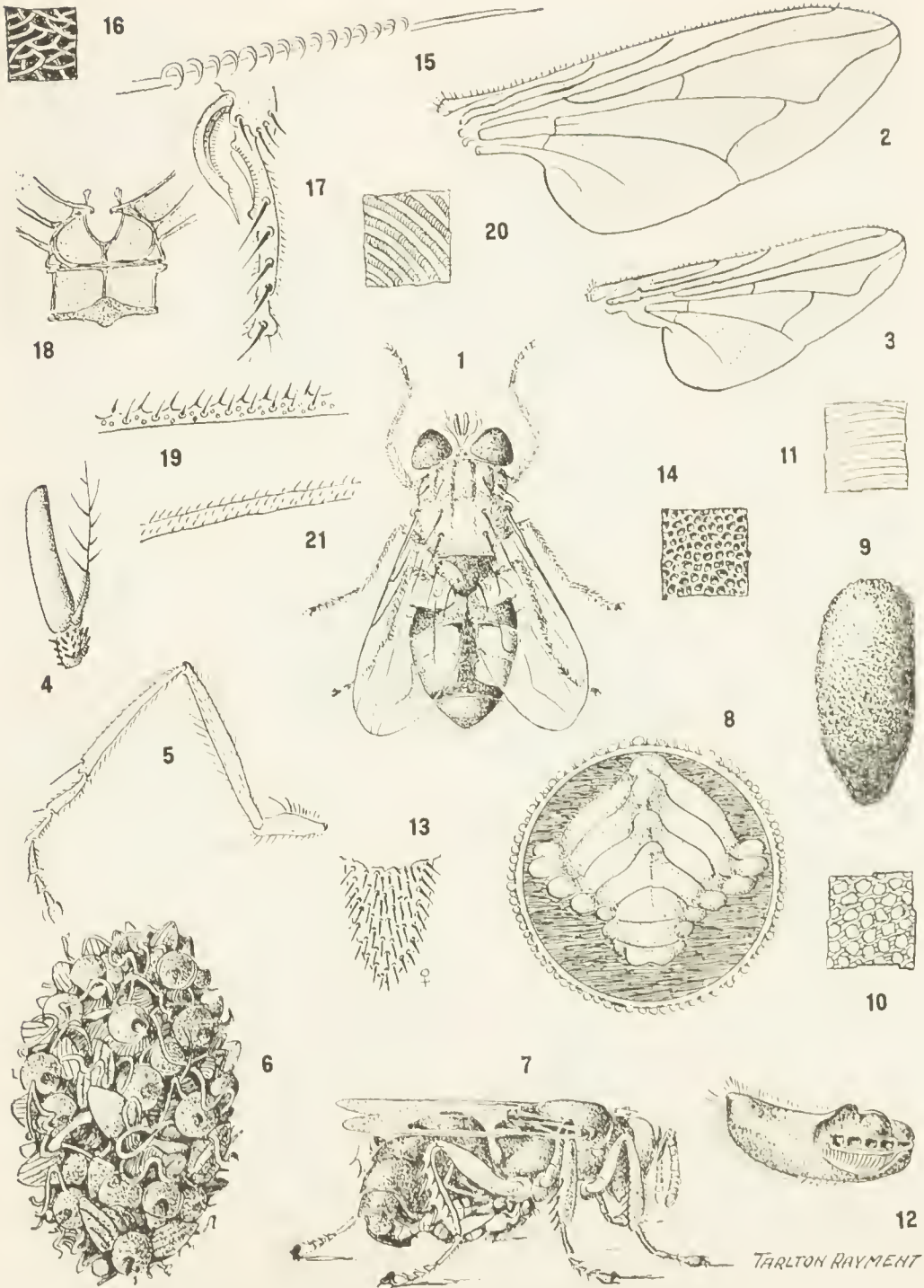
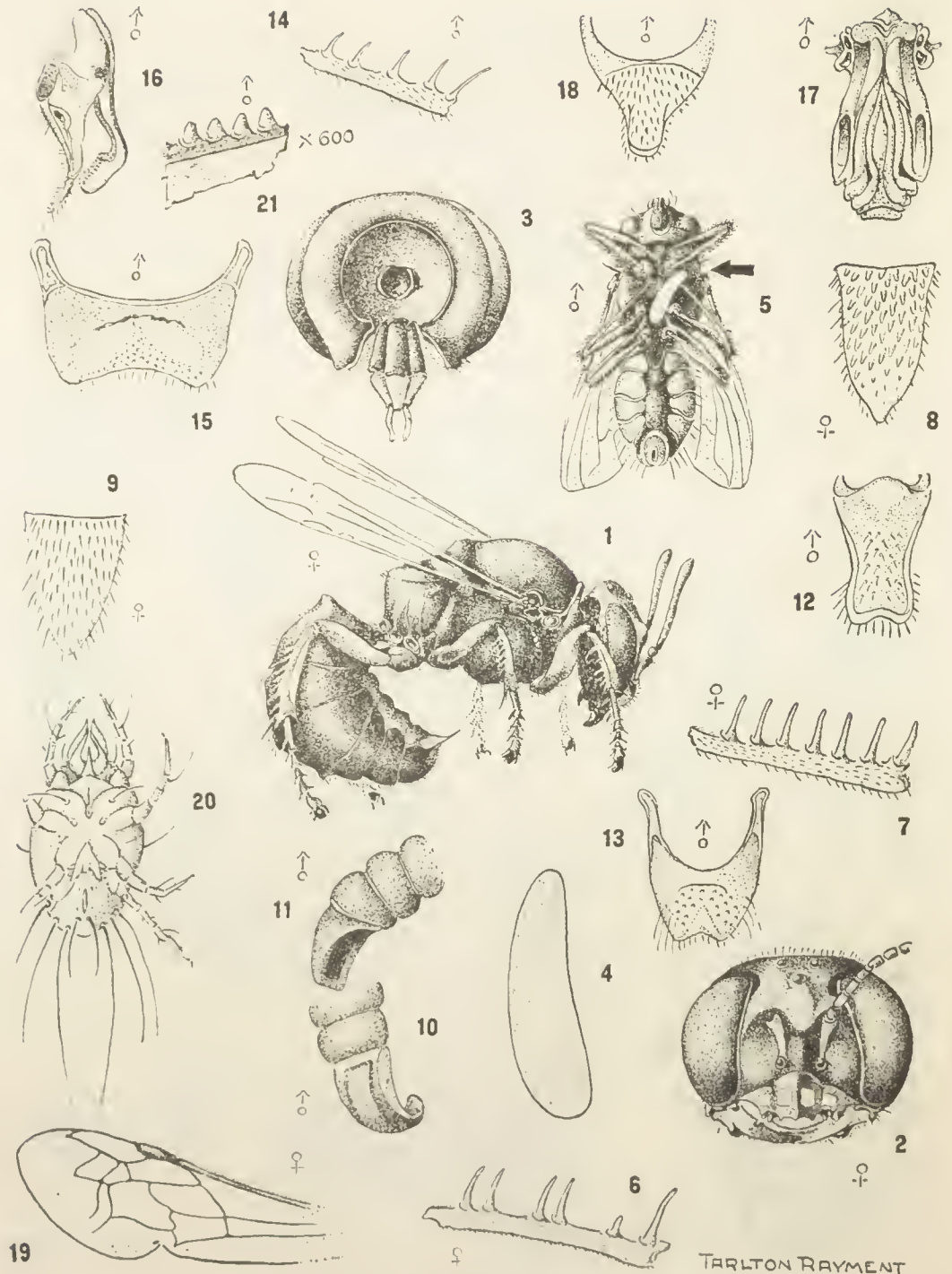


PLATE 2. Details of Wasp *Sericophorus sydneyi* Raym.



TARLTON RAYMENT

PLATE 3. Details of *Sericophorus*.

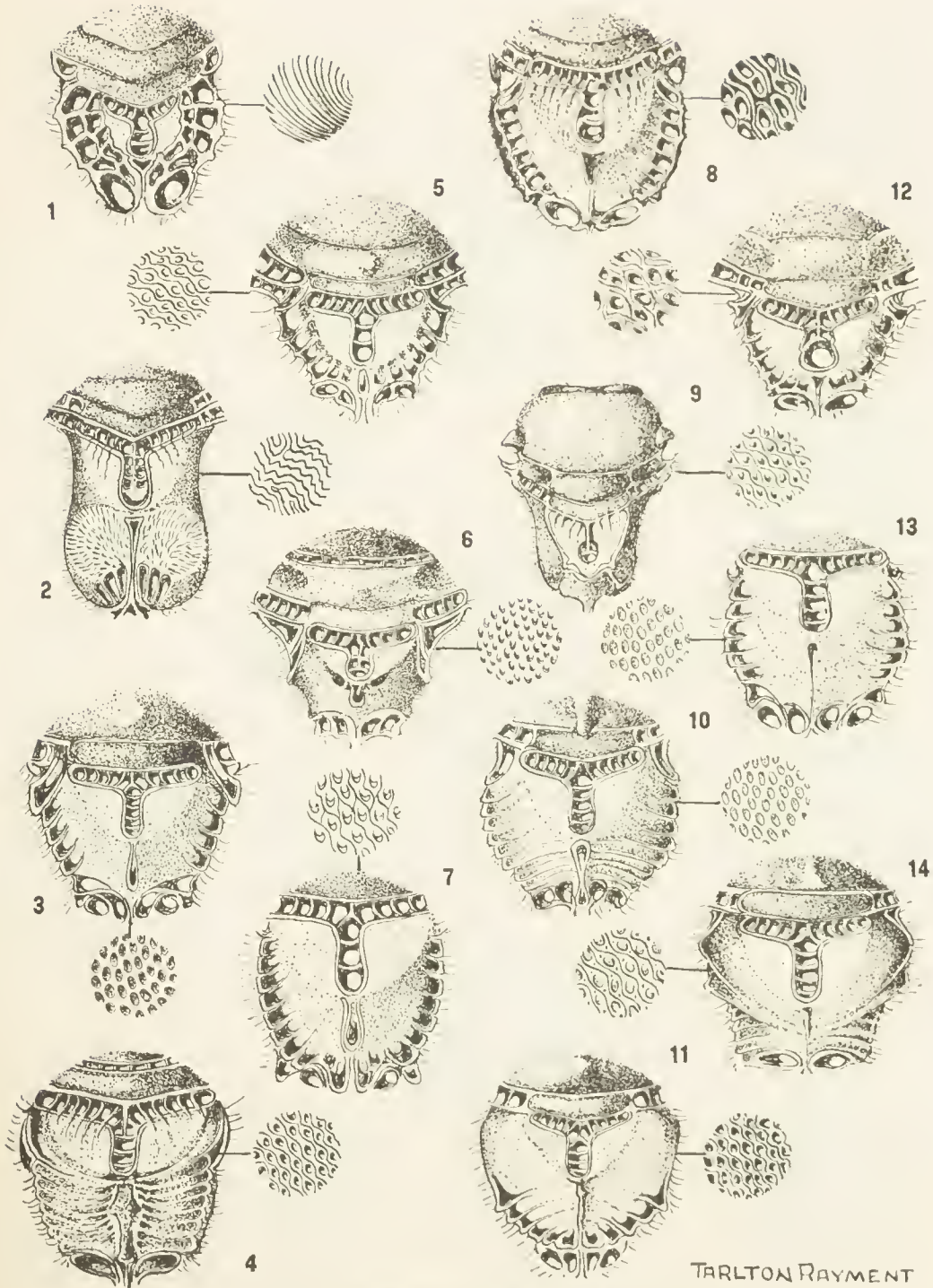


PLATE 4. *Sericophorus*. Views of Metathorax.

TARTLTON RAYMENT

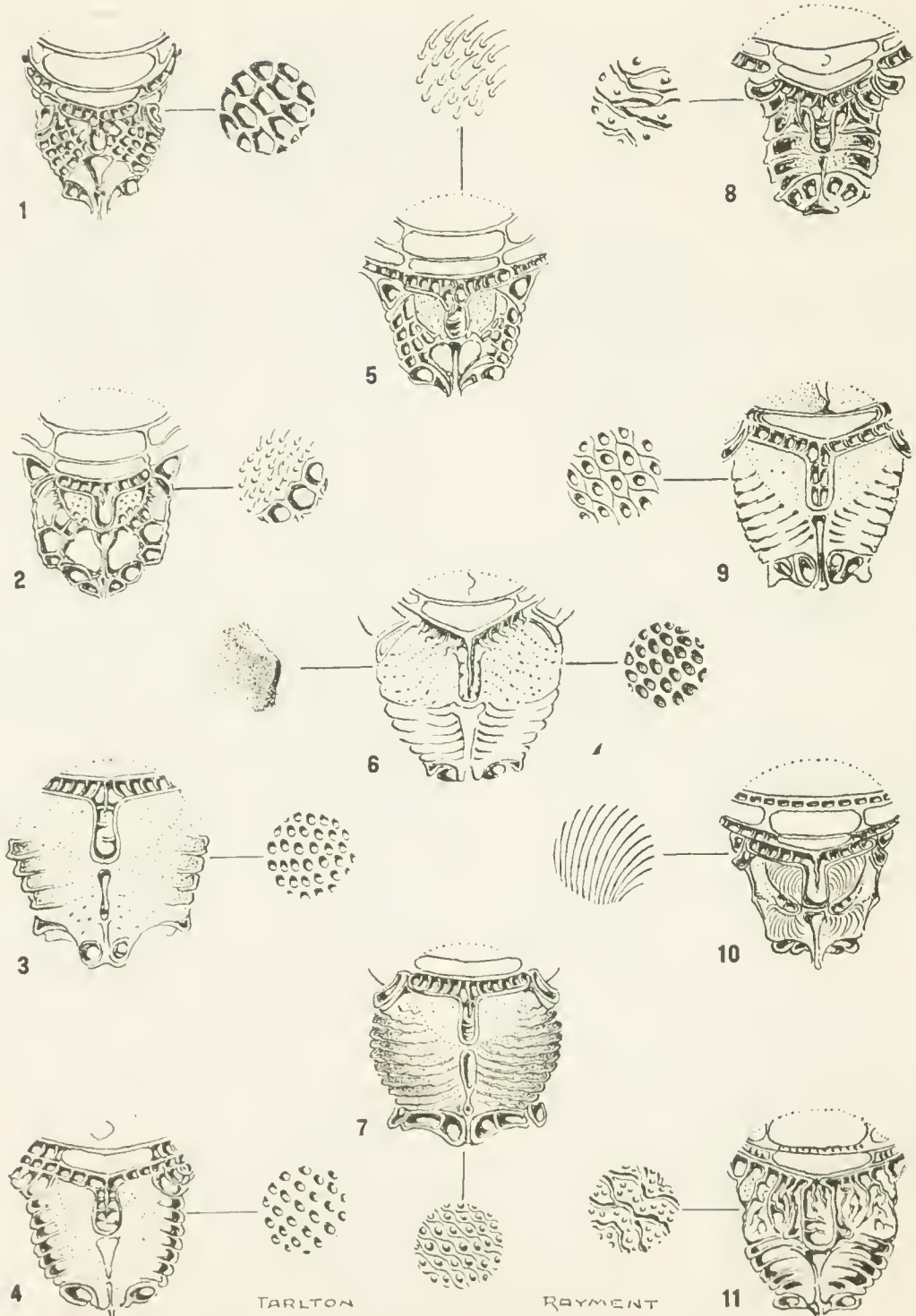
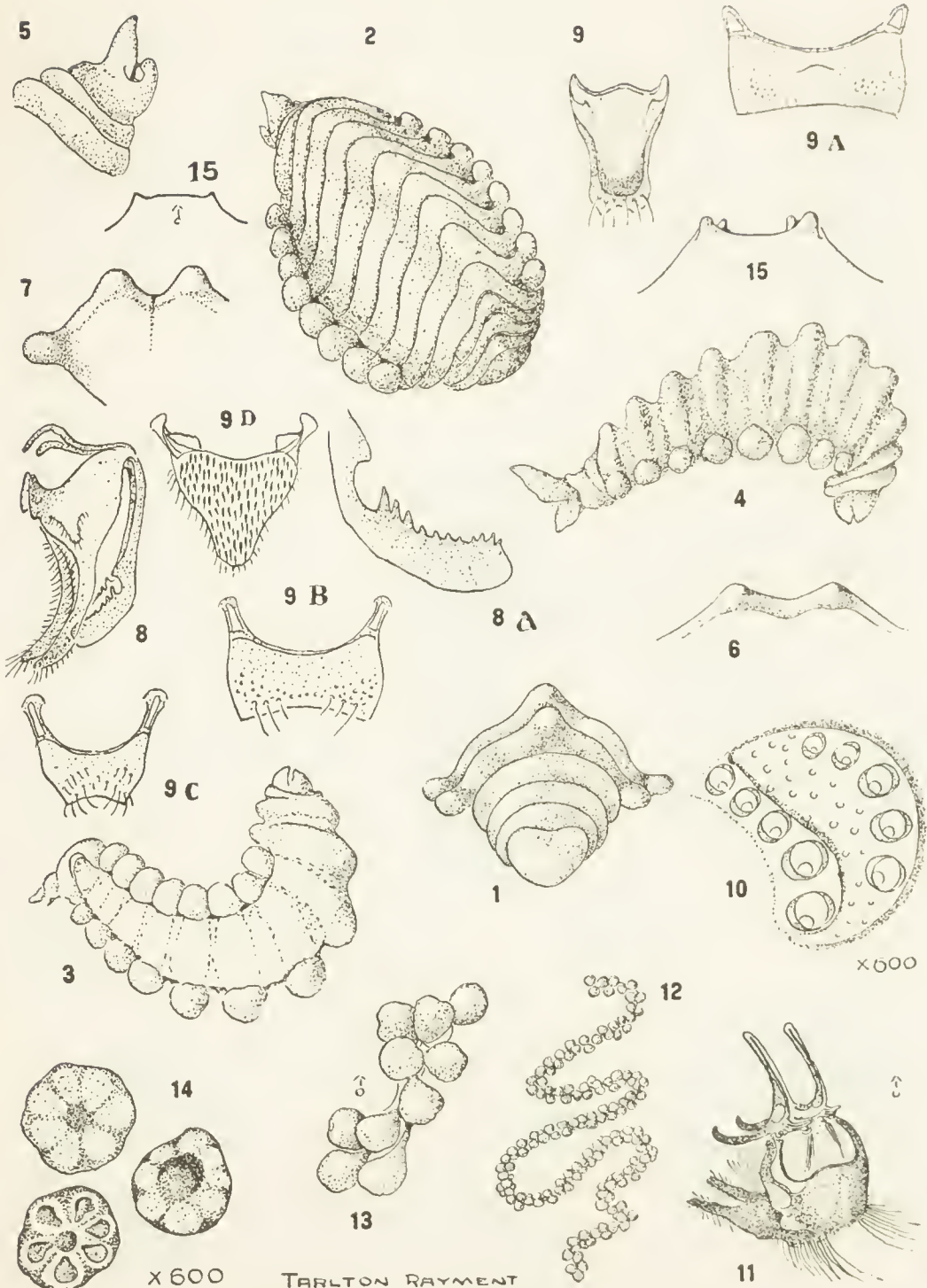


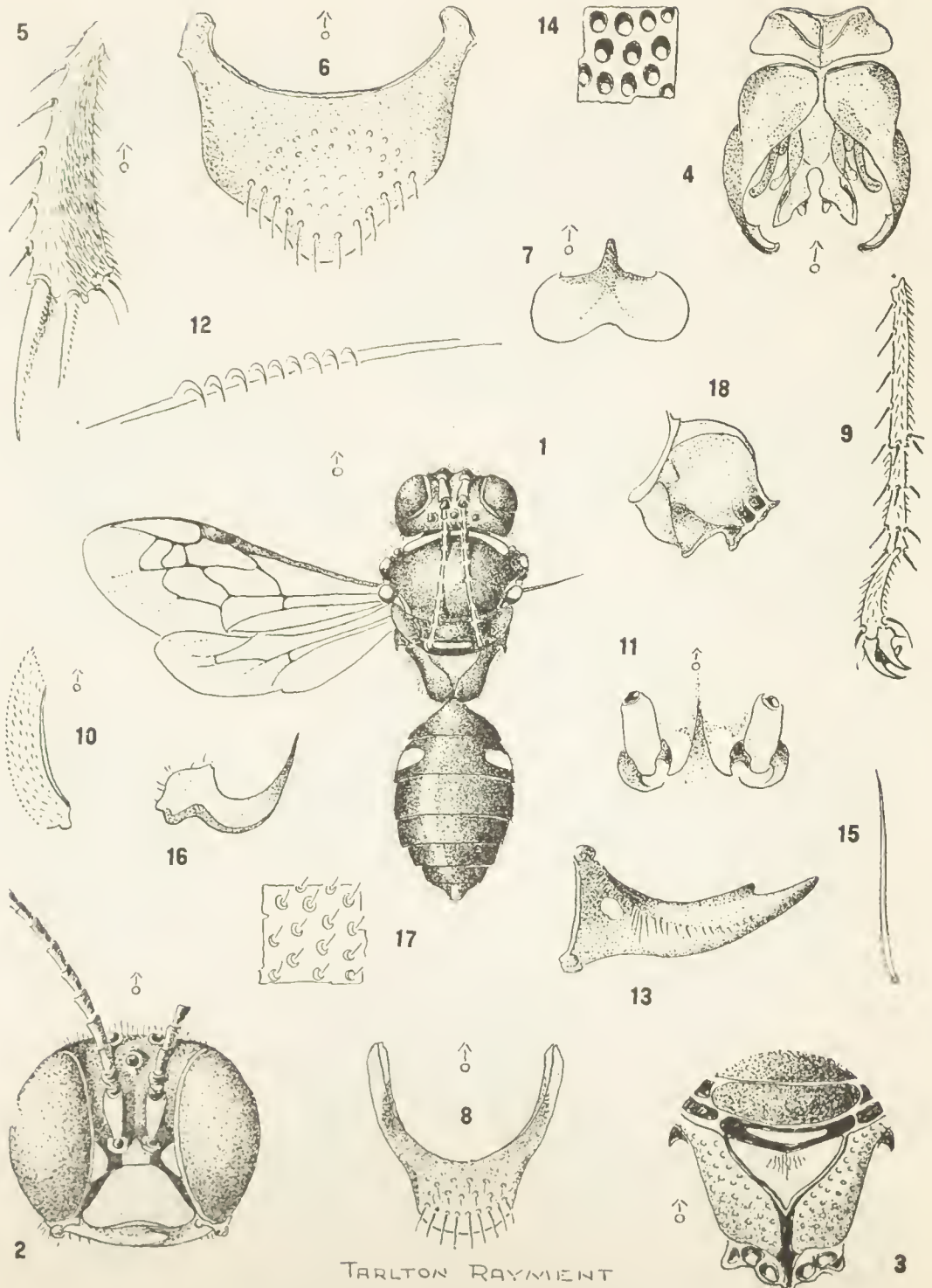
PLATE 5. *Sericophorus*. Views of Metathorax.



X 600

TARLTON RAYMENT

PLATE 6. *Sericophorus* larva and other details.



TARLTON RAYMINT

PLATE 7. *Astaurus hylaeoides*.

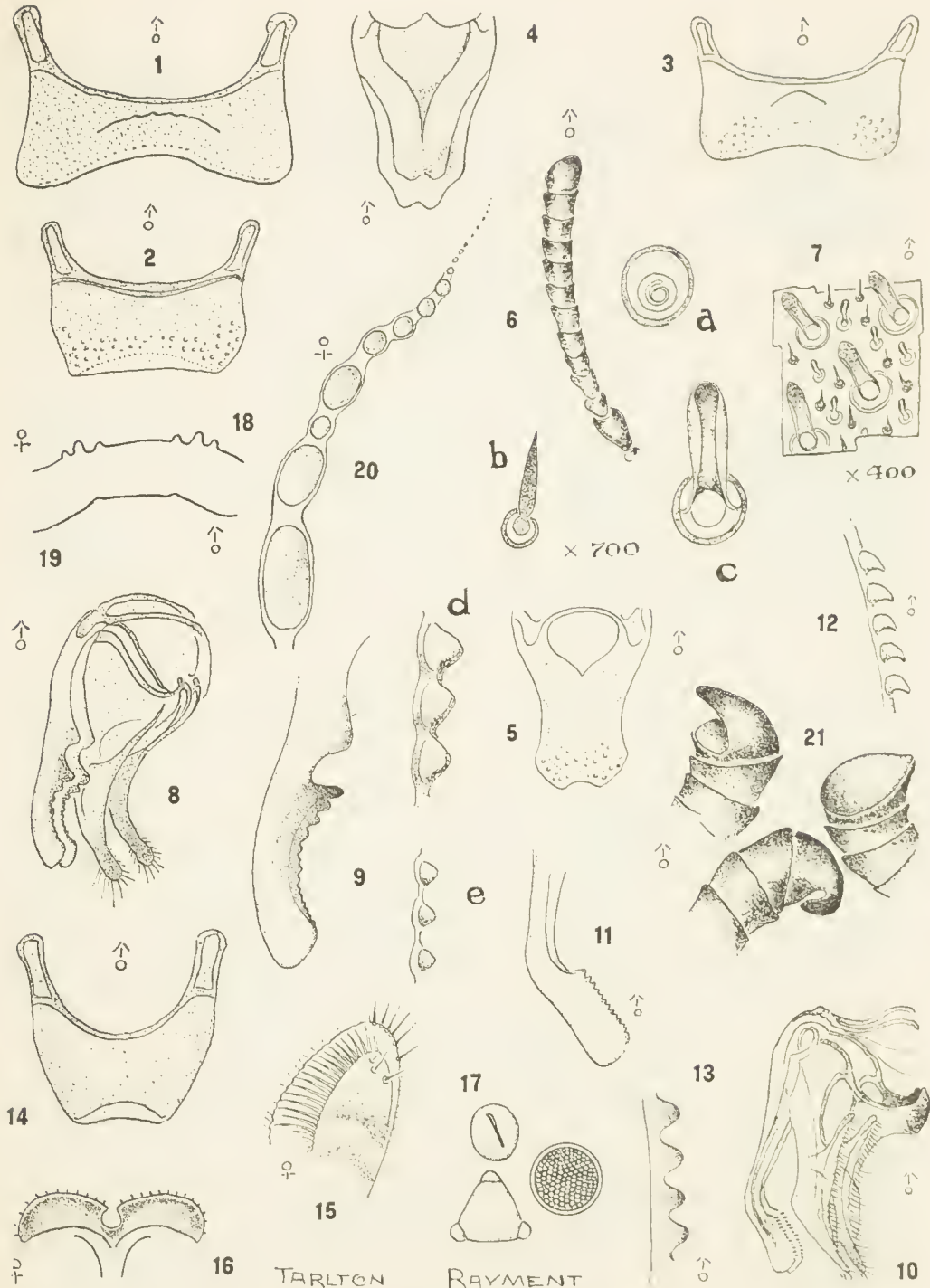


PLATE 8. Morphological details of male Wasps *S. tallingensis* and *S. cliffordi* Raym.

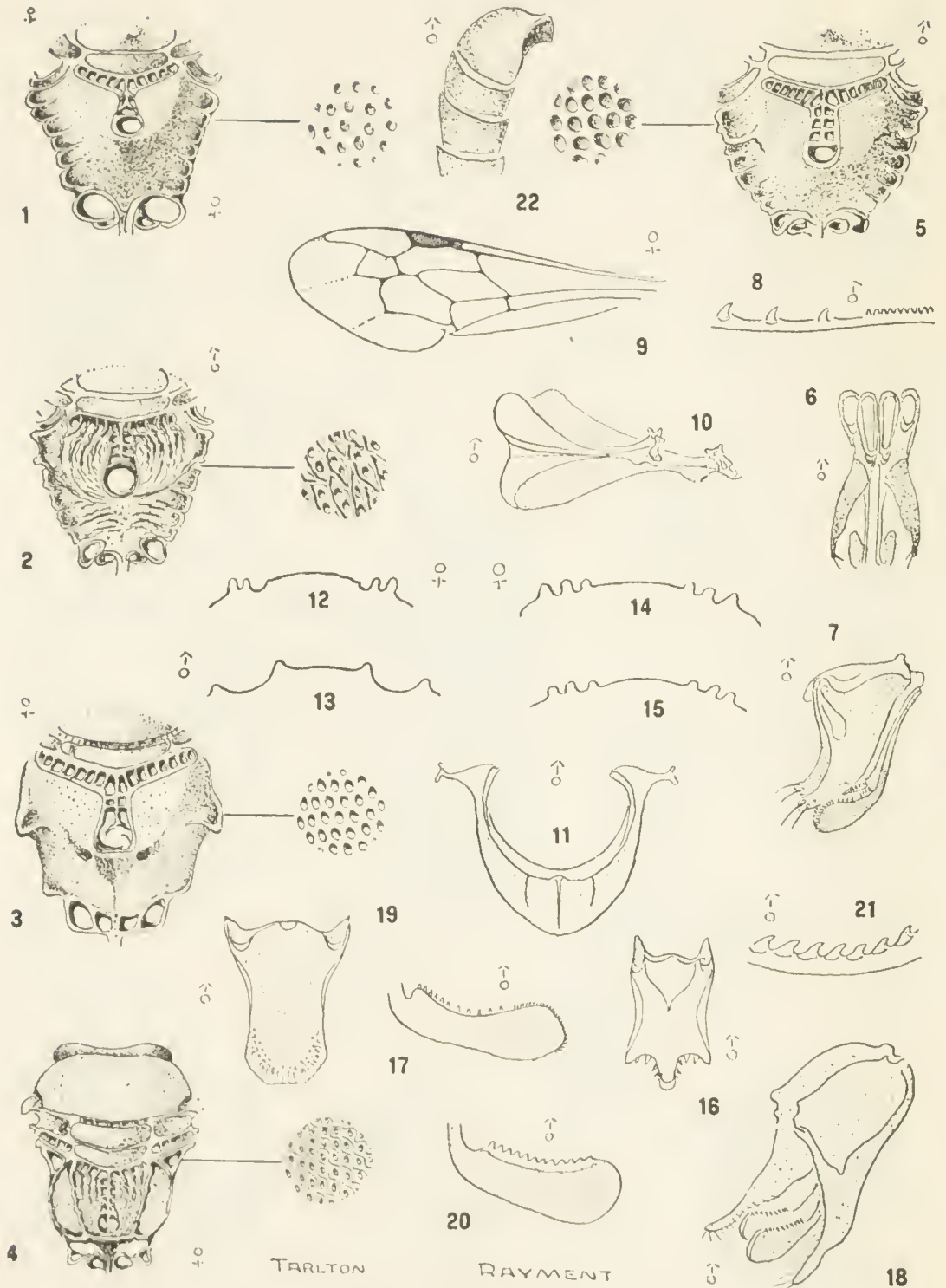
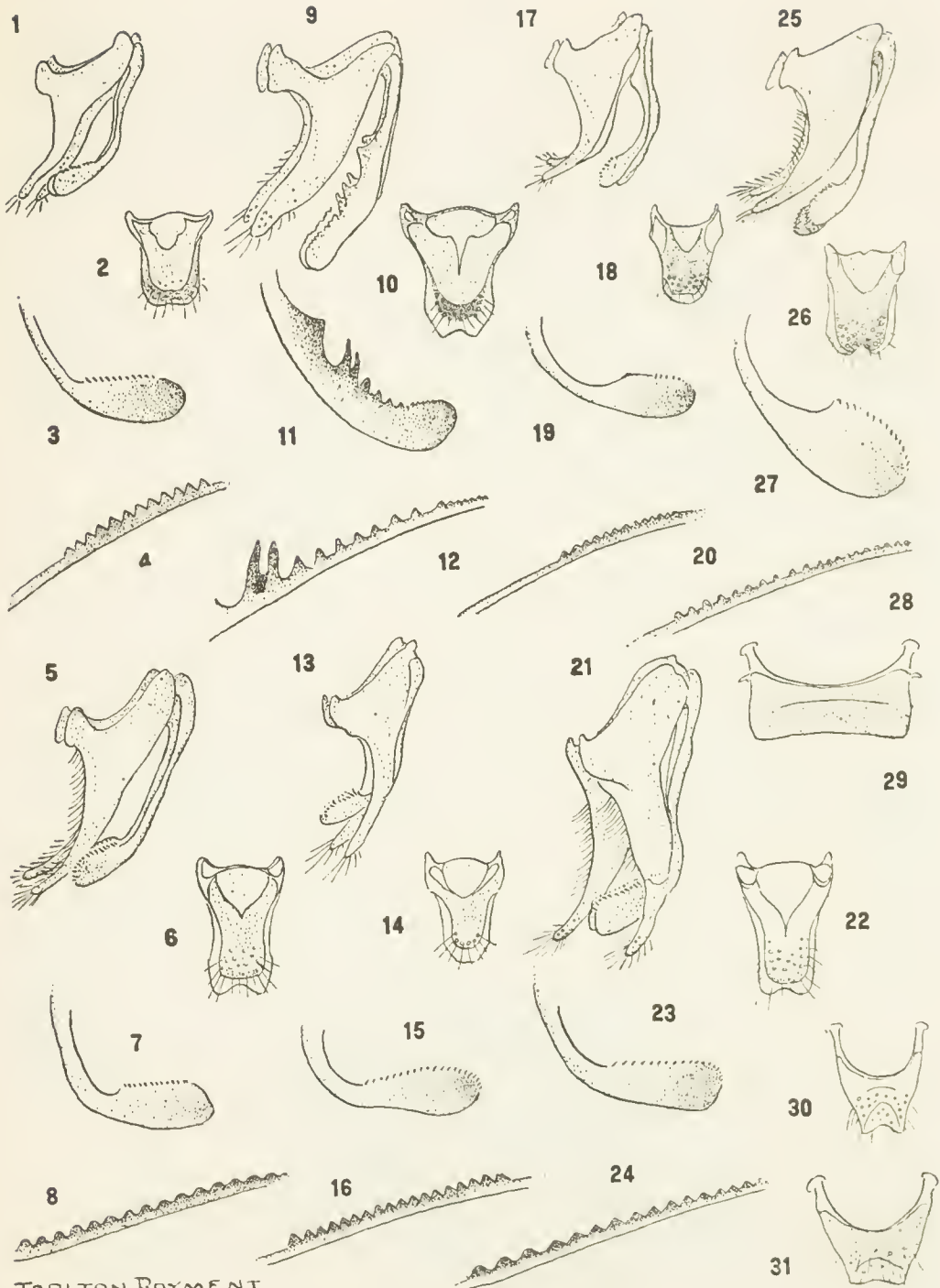


PLATE 9. *Sericophorus*.



TARLTON RAYMENT

PLATE 10. Sericophorus males.

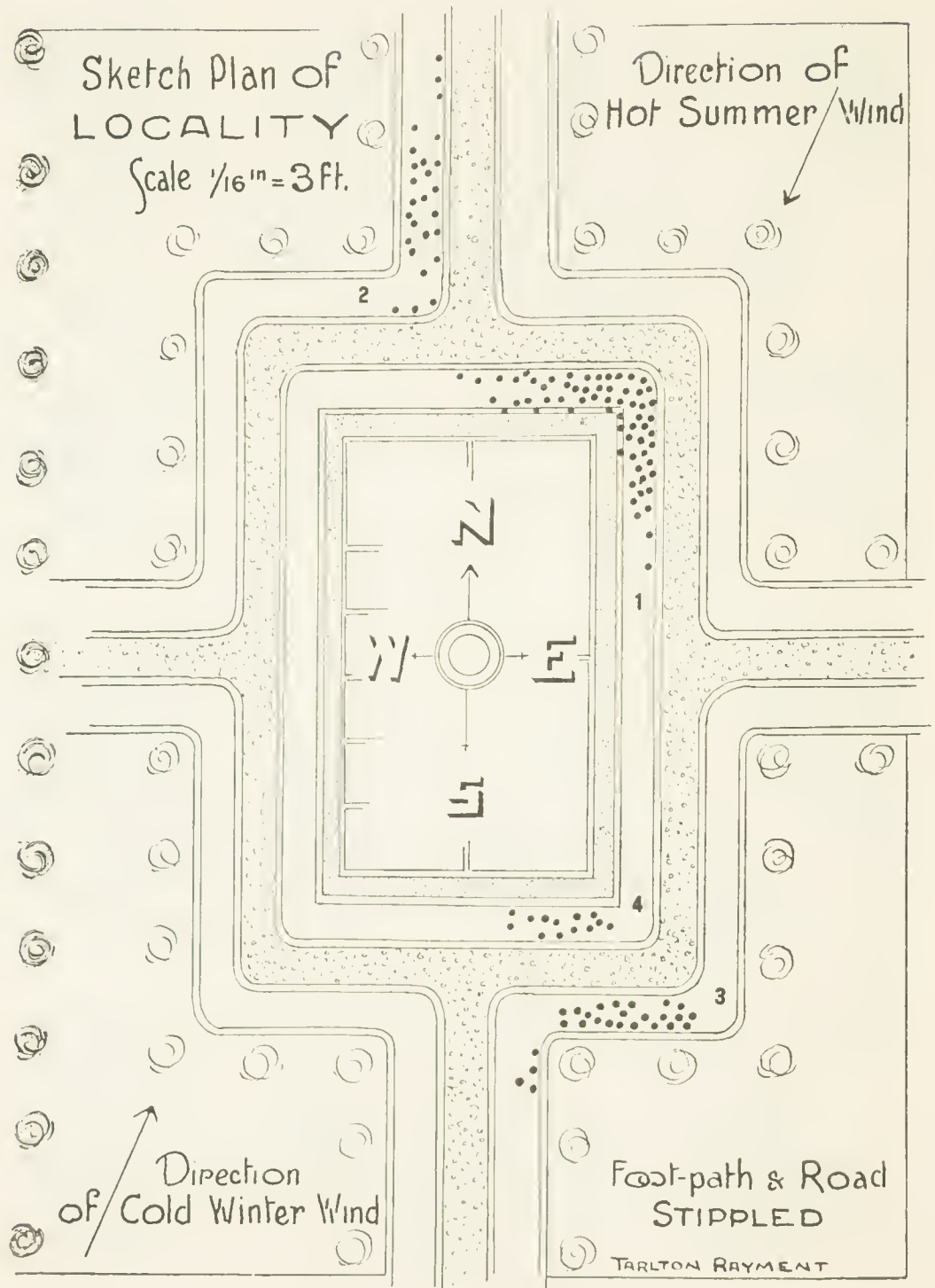
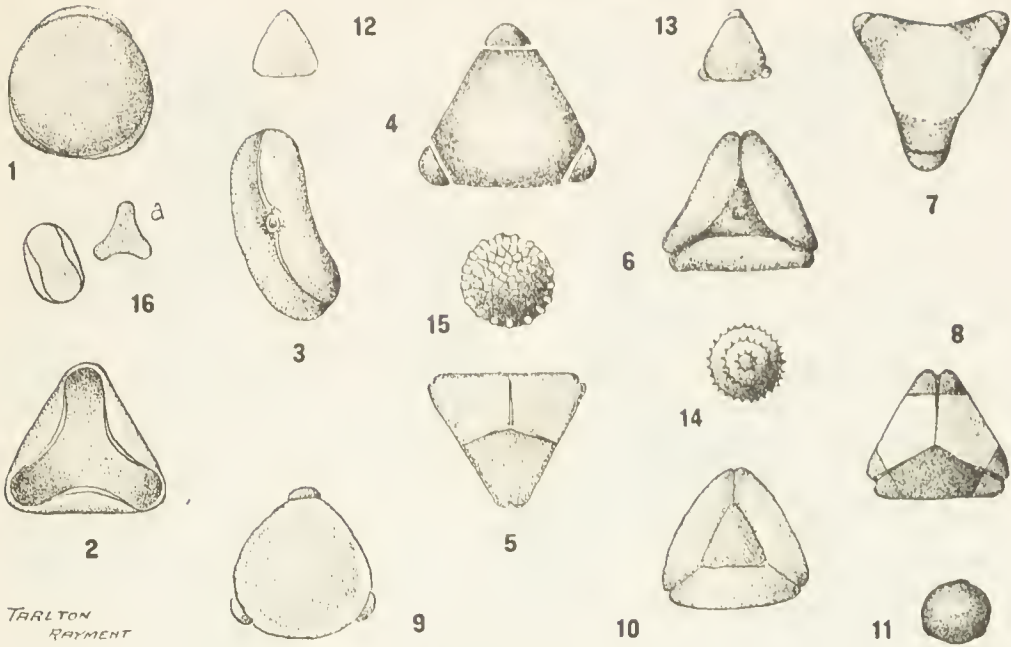
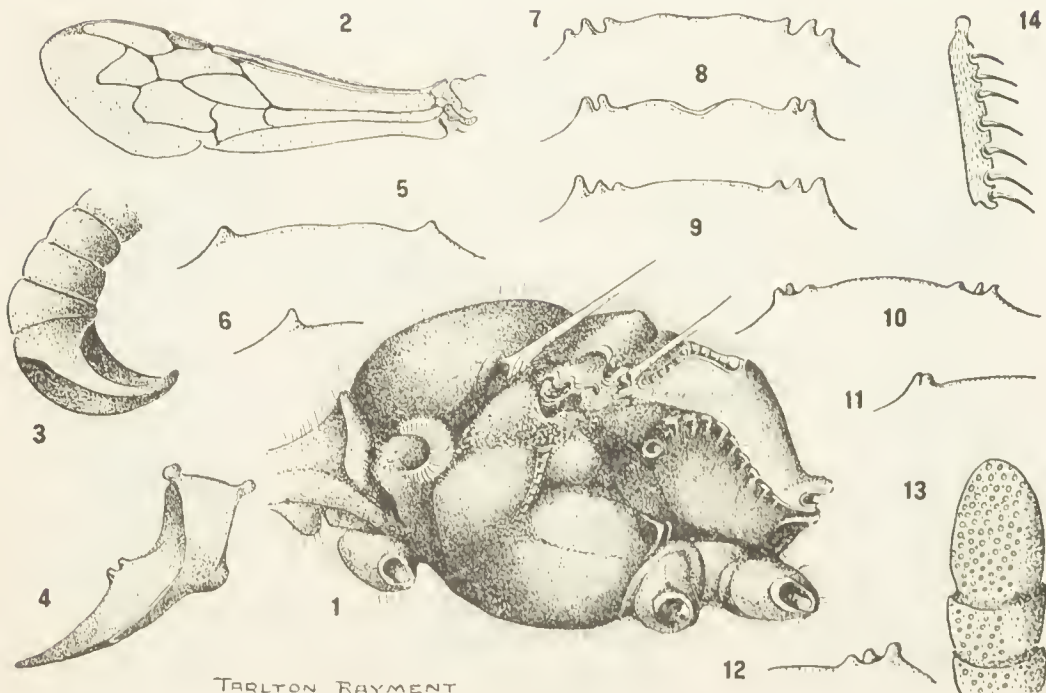


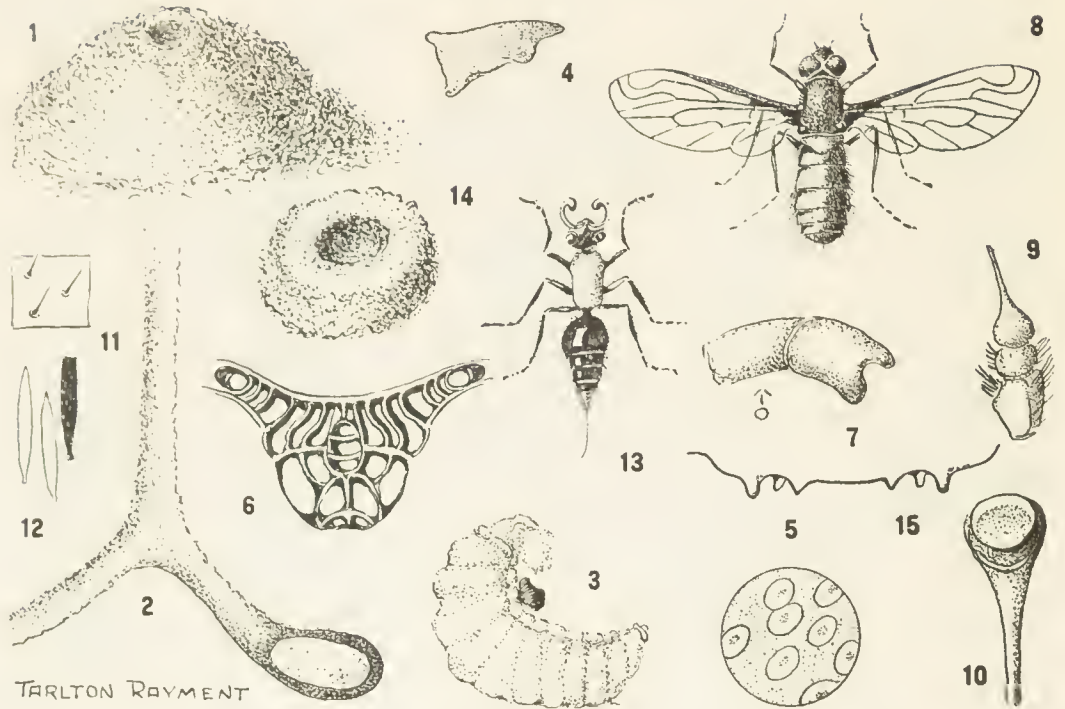
PLATE 11. Locality of nests of *Sericophorus*.



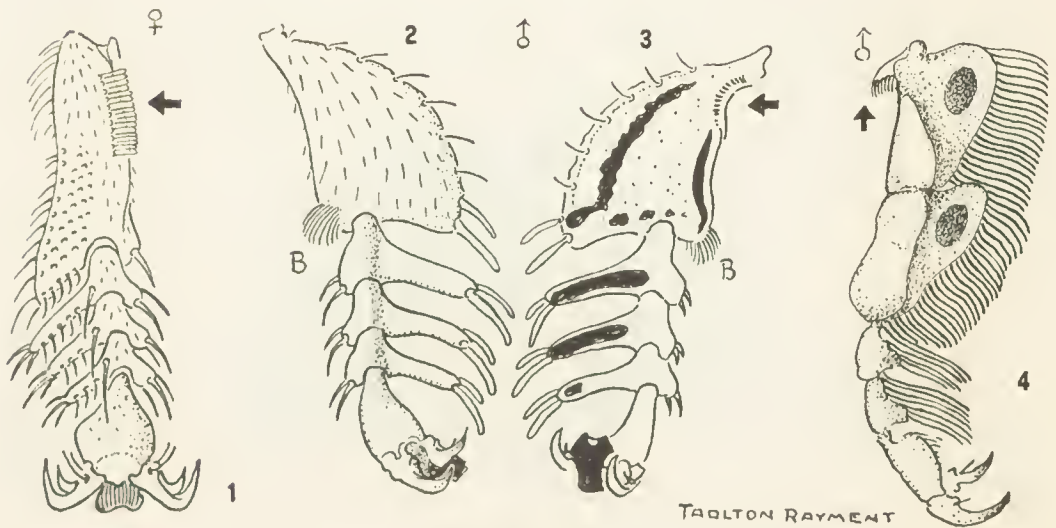
TEXT FIGURE 1.



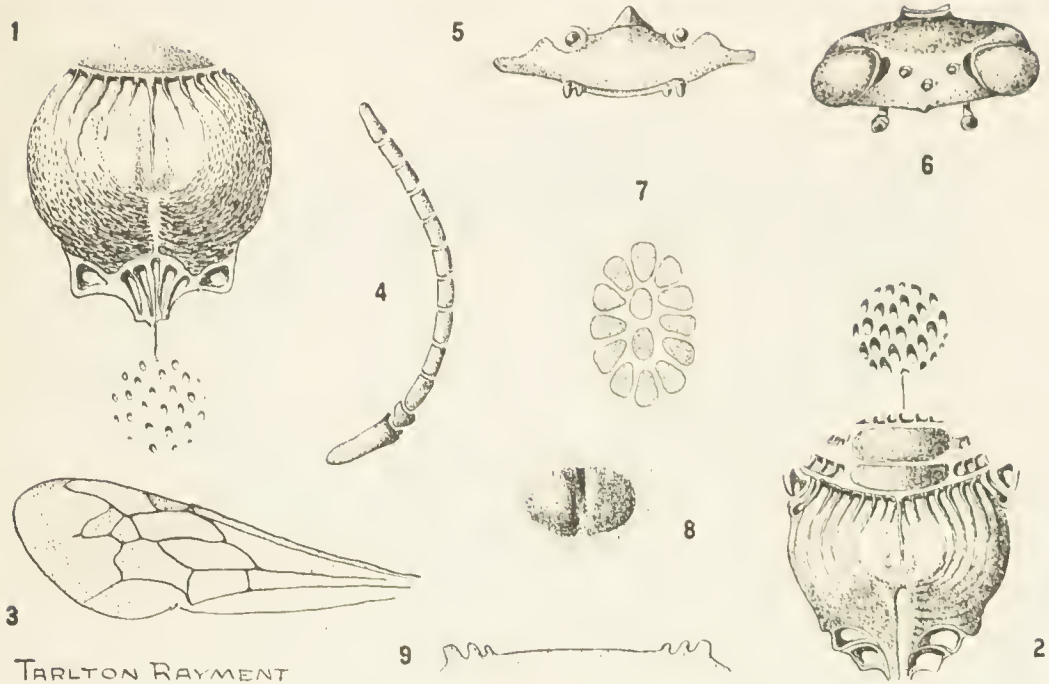
TEXT FIGURE 2.



TEXT FIGURE 3.

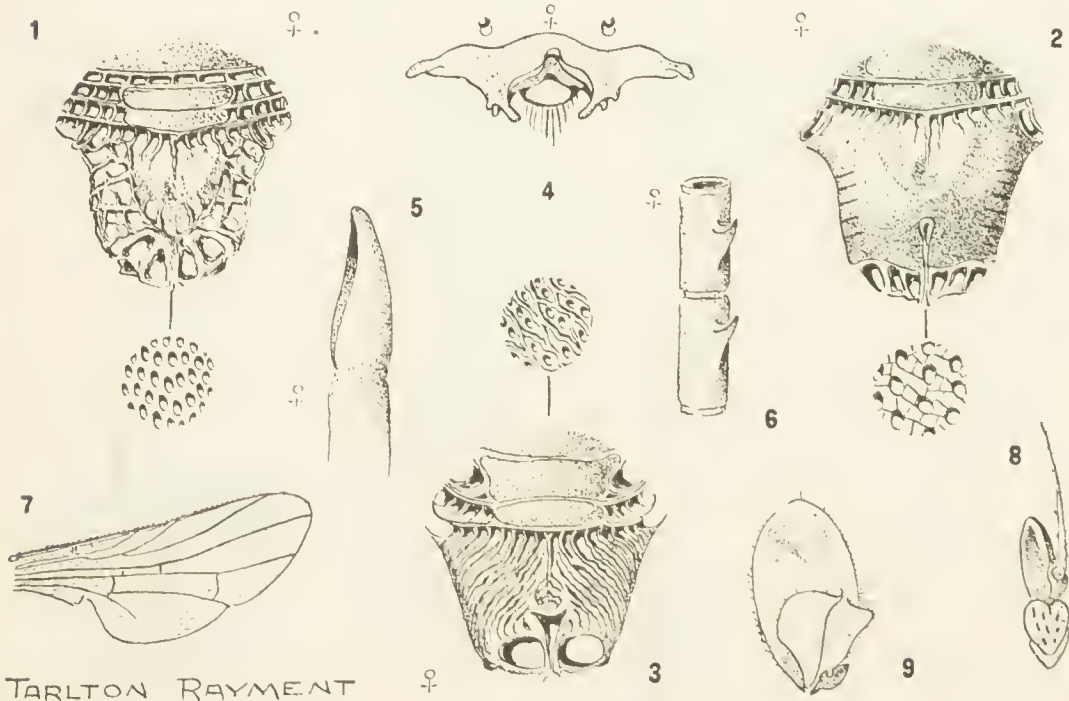


TEXT FIGURE 4.



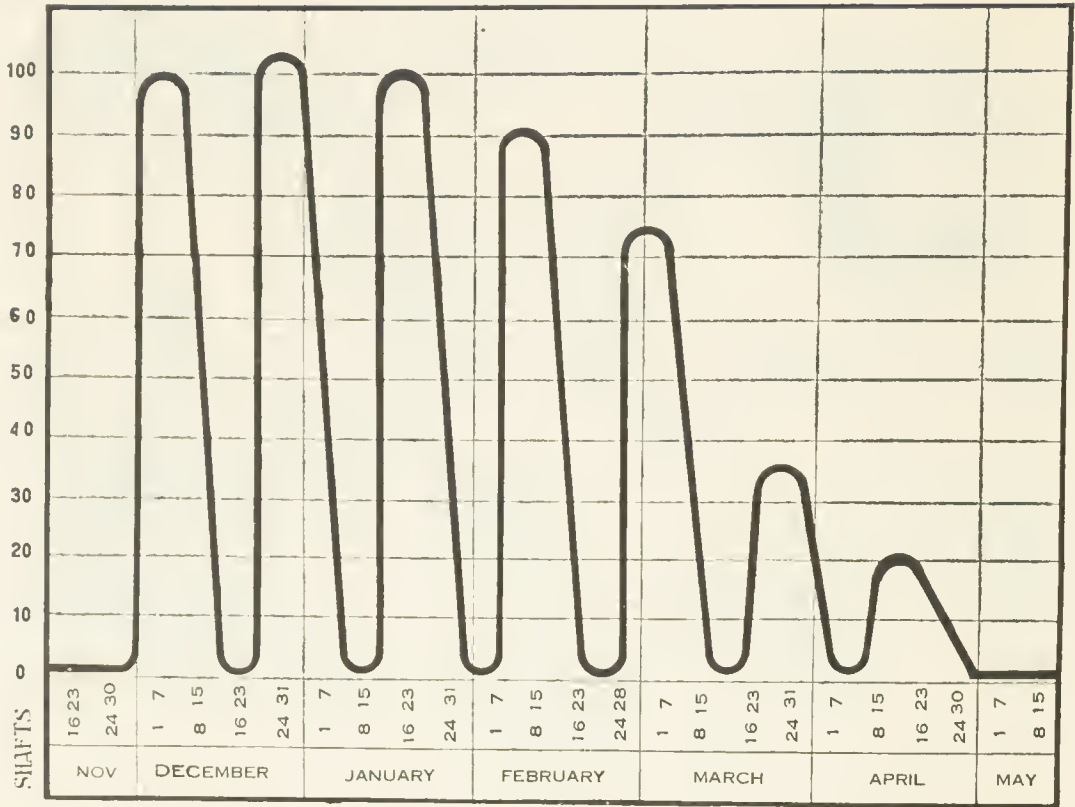
TARLTON RAYMENT

TEXT FIGURE 5.

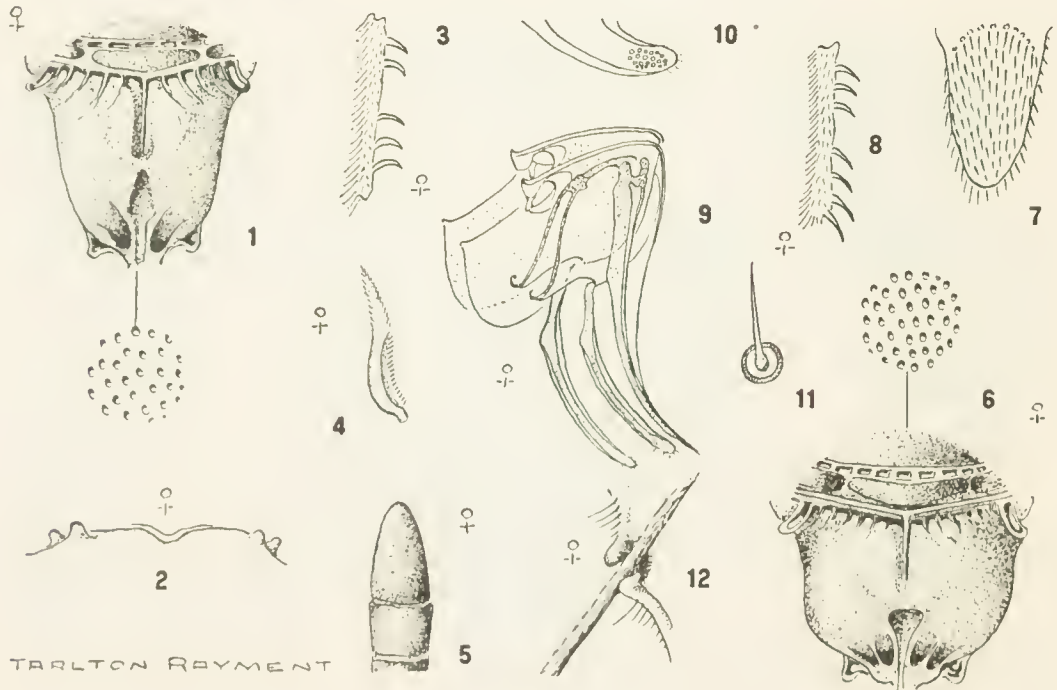


TARLTON RAYMENT

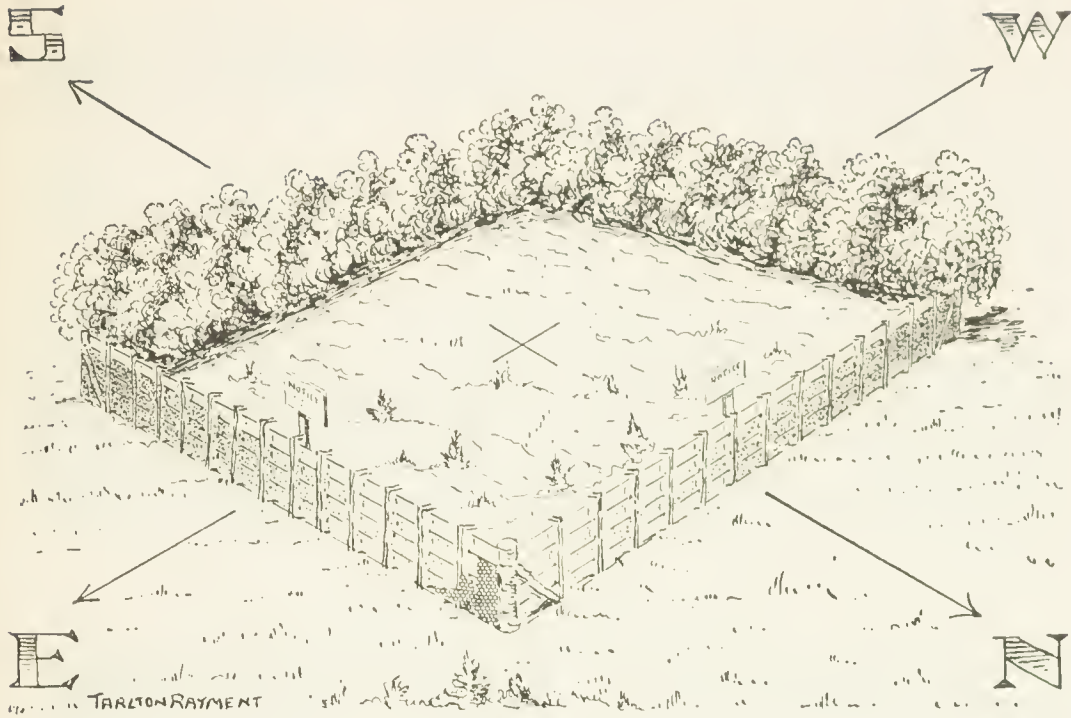
TEXT FIGURE 6.



TEXT FIGURE 7.



TEXT FIGURE 8.



TEXT FIGURE 9.